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Psychology in Business

President Wilson is at least partly right when, in discussing psychology in business, he argues that the attitude of business men affects the state of business. Good times are more likely to come when we expect them and work to bring them about than when we expect bad times and work only half-heartedly to prevent them. A look toward good times does not always bring good times, but a look toward bad times is very likely to bring about events that accelerate the downward movement. While we agree, therefore, that there is an element of psychology in the business situation, we believe that it does not always control trade. The causes of our momentary unrest appear too clear to dispute. We think that the main cause of any psychological depression that exists now is the legislative situation at Washington. If business is actually good in a given industry, the facts will show it. If it is not good, the facts are the surest evidence of its real condition. If the facts show good business, the state of mind to which the President refers arises from influences not directly connected with the volume of trade. It is reasonably plain to candid observers that the principal influences of this kind are the measures pending in Congress for the regulation of business. Will these measures be harmful or helpful to business? When that question is answered speculation as to their effect will be in a fair way to be succeeded by fact. Then, no matter what is detrimental it will be the first duty of business men to readjust their practices where necessary, to conform to the law of the land, and to go ahead and do business with full confidence that if adverse legislation has to be borne the strength and common sense of the country will enable it to rise superior to this burden.

Labor Unions in Trust Laws

The legislation proposed for the exemption of labor unions from the anti-trust laws has been passed by the House of Representatives and is now before a comtee of the Senate. It provides "that nothing contained in the anti-trust laws shall be construed to forbid the existence and operation of fraternal, labor, consumers', agricultural or horticultural organizations, orders or associations instituted for the purpose of mutual help and not having capital stock or conducted for profit, or to forbid or restrain individual members of such organizations, orders or associations from carrying out the legitimate objects thereof." This is a perfectly plain statement that such organizations may be formed for legitimate objects. The natural inference is that these organizations may do what they want to so long as they do not do anything that is not legitimate; but before that inference is drawn the concluding words of the paragraph should be read: "Nor shall such organizations, orders or associations or the members thereof be held or construed to be illegal combinations or conspiracies in restraint of trade under the anti-trust laws." The bill says in effect that the organizations shall not be restrained from carrying out legitimate objects. Should it not read "lawful objects"? Do the lawmakers mean to say that if these organizations do things which are not lawful they shall not be construed to be illegal combinations or conspiracies in restraint of trade? If they do not mean that, what do they mean? Either this section means nothing in law or it means a great deal more than it ought to mean. If a thing is forbidden, it ought to be forbidden for all. Even if the wording of the section is so ambiguous that the interpretation which the courts will give it is doubtful, it is open to severe criticism as class legislation. The Senate should have the courage and independence to make any acts that it passes applicable alike to all classes.

Commutation Phenomena

The subject of commutation is very easy to understand and explain in its broadest and simplest aspects, but when it is discussed in full detail it becomes so complicated a matter that a complete analysis is hopeless. Nevertheless, it is understood by designers of direct-current machinery sufficiently well to enable them to produce satisfactory results. There are various ways of presenting the electrical phenomena of commutation from a quantitative point of view. One way is to symbolize the various quantities and then to deal with these symbols mathematically. Another way is to use as few symbols as possible, but to rely on graphical methods, as far as possible, for picturing the physical relations. The former method is essentially that of the mathematical physicist, and the latter that of the technician or of the experimentalist. An example of the latter method is presented in the article by Prof. Alfred Still the first part of which appears in this number. The illustrations indicate that certain assumptions are made in the discussion which greatly simplify the analysis and yet are reasonable from a practical standpoint. The result is that, with the aid of the diagrams, it becomes easily possible to compute the working mmf necessary to apply on the interpoles of a direct-current machine in order to predetermine sparkless commutation at the usual loads.

Definition of Photometric Units

An interesting paper has recently been presented by Mr. A. P. Trotter to the (British) Illuminating Engineering Society, commenting upon the report of a committee of the (American) Illuminating Engineering Society concerning photometric nomenclature and units. Mr. Trotter takes exception to some of the American definitions, because these are based essentially on the concept of "flux of light," instead of being based on the "candle" as a luminous point source. His contention is that the concept of a candle is simpler than that of a lumen, as well as much more firmly established in the photometric art, so that it would be better to base all photometric definitions as far as possible on the candle and keep the notion of luminous flux subsidiary. The American committee's report is manifestly addressed to technical readers, for the purpose of suggesting standard photometric definitions and conceptions in both national and international discussion. Incidentally, it was evidently framed with the object of eliciting just such critical discussion and debate as has recently been published in England. The ideas therein reflected are largely due to M. Blondel, who has contributed so largely to the nomenclature, logic, units and methods of measurement in photometry.

As regards the relative importance of the candle and the lumen, the state of affairs in photometry is very similar to that in the sciences of electricity, magnetism and radiation. In all of these cases the primitive idea, and the first to lend itself to quantitative development, was the point source. In electricity it was the point charge, in magnetism the point pole, in radiation the point radiant, in photometry the luminous point. The fundamental units of electricity and magnetism are derived from point sources. Thus, the unit electric quantity is that which repels its equal with unit force at unit distance, and the unit magnetic quantity is the same with respect to point poles instead of point charges. In early stages of applied electricity and magnetism, the point-source concepts and their descendants worked fairly well; but after a time they broke down from sheer inadequacy and had to be superseded by working conceptions based on fluxes.

In photometry, again, the primitive conception was based on the point source, but it is not too late to place international photometric science on a flux basis. An illumination of 1 ft.-candle is more fundamentally a candle-lumen per square foot than the illumination produced by a point source of one candle at a distance of one foot. Actual lamps are far from being point sources. They present, in fact, luminous surfaces of various sizes and shapes. What they necessarily and essentially produce are lumens. Ultimately, photometry hopes to become quantitatively dependent on the science of radiation, so that an assigned distribution and character of radiant flux shall determine a consequent attendant luminous flux. To such a conception the notion of a candle as a fundamental magnitude is purely empirical, whereas the notion of a luminous flux is a perpetual suggestion. As regards the fashioning of units in applied science to suit the supposed requirements of the man in the street, or the purely practical man, there is, we believe, no need of giving special consideration to him. He is abundantly well able to look after himself. What he wants is simplicity and accuracy in his working conceptions. But that is also just what the technical man needs. The best definitions, notions and nomenclature for the engineer are the best also for the untechnically trained worker.

Tests of the Gas-Filled Lamp

There has recently come from the hands of Dr. Lux, whose photometric researches are already known to our readers, a somewhat careful study of some of the characteristics of the so-called "half-watt" lamp as developed in Germany. Considering the fact that the gas-filled lamp in its present incarnation is an American invention, it is rather extraordinary that the most complete account of it, as well as some of the very earliest applications, have come to us from abroad. As is well understood, the gas-filled lamp differs radically in its conditions of efficiency from the ordinary vacuum lamp with metallic filament. In the latter the loss of energy from the filament, save by radiation, is very small, while in the former the convection losses are heavy. One endures this loss with equanimity, however, in view of the fact that by reason of the presence of the gas the working temperature can be pushed enormously higher than in the case of a vacuum lamp, and the blackening is carried to the top of the bulb by the convection currents. Dr. Lux investigated side by side with photometer and bolometer a gas-filled and an ordinary vacuum metallic-filament lamp, determining the specific consumption and absolute temperature of the filament at various impressed voltages.

The ordinary metallic-filament lamp increases in candle-power rather more rapidly with change of temperature of the filament than does the gas-filled lamp, as might be expected. The most distinctive difference between the two is in the distribution of losses in the lamp. The radiant energy from the two sources was separated roughly into the visible and invisible portions by means of a ray filter of copper chloride solution which cuts off substantially all the infra-red and a small portion of the red. In the case of the ordinary metallic-filament lamp the light radiation was 4.4 per cent of the total radiation and 3.7 per cent of the input; that is, in this particular type of vacuum lamp a little over 88 per cent of the energy supplied was delivered in the form of radiant energy. With the gas-filled lamp only 60 per cent of the supplied energy appeared as radiation, so that roughly almost a third of the energy supplied in this very efficient lamp is dissipated by radiation and conduction. Nevertheless, the efficiency of the lamp with respect to its luminous output in terms of the total input rises to almost 5 per cent, and the luminous radiation alone is somewhat over 8 per cent of the total radiation.

The facts just noted bring out the large improvement in efficiency gained by increasing the temperature, as can be done in the presence of the gas filling, while they also emphasize the large thermal losses which are the price paid for the gain. However paradoxical it may seem at first, the gas-filled lamp comes nearer to furnishing "cold light" than does the ordinary tungsten lamp, for the simple reason that the luminous efficiency of the former is so strikingly increased that, so to speak, the light outruns the heat. In point of fact, Dr. Lux found that the heat radiation from the gas-filled lamp per candle-power of light given was rather less than one-third that in the ordinary tungsten lamp. The gas-filled lamp, as everybody now knows, undeniably operates with a very high temperature at the globe, although the radiation per candle-power is kept low. The high bulb temperature of the new lamp is in the main chargeable to the carrying off, as an incident to its operation, of an exceptionally large amount of heat to the walls of a relatively small bulb.

Economy of Central-Station Service

In a very striking article published recently in the *Elektrotechnische Zeitschrift*, Dr. Walter Straus compared the economic results to be obtained from central-station service with those of various sorts of localized energy-producing systems. Such comparisons have been made frequently, but never before, so far as we are aware, in so thorough and up to date a manner. While the relative costs and prices would be somewhat different under American conditions, we think that, on the whole, the case would be slightly better for central-station service here than in Germany, where labor in an isolated plant is relatively cheap and the costs of the machinery somewhat less. The conditions assumed by Dr. Straus are first a 15-kw output required; second, 110-kw, and third, 400-kw. The first would represent a typical motor installation of small size, the latter two the larger and more important cases in which, on the whole, a local source of energy would be more seriously considered.

Dr. Straus brings to the front small prime movers of relatively very high efficiency, so that the comparison is not based on steam power or ordinary gas engines but on the very best that is available for the production of energy in small quantities. In every comparison the whole costs are taken into account, from the material consumed to the capital costs and the cost of the space occupied. The sources of energy taken for comparison with electric service at prevailing prices are the ordinary gas engine, the producer-gas engine, the gasoline engines, steam engines of the ordinary sort, the locomobile, and the Diesel oil engine. These certainly represent among them the best for the economical production of small amounts of energy. With the cost of energy obtained from these sources for periods up to 3000 hours per year in the small units and 6000 hours per year in the larger ones Dr. Straus compares the cost of electric service at 1.25, 2.5, 2.75, 5 and 6.25 cents per kw-hr. The results of this comparison are very striking.

With a 15-kw unit under full load for 3000 hours per year the electric motor would theoretically be less economical than the producer-gas equipment, the Diesel oil motor, the ordinary gas engine, the locomobile and the gasoline motor, in the order named. Every engineer realizes, however, that a condition calling for full load for 3000 hours per year is seldom or never encountered in practice. The hypothesis of ordinary use next introduced is that there will be full load for a third of the time and half load for two-thirds of the time. Under these conditions for 3000 hours' use per year only the Diesel oil engine and the producer plant are left as substantial competitors of electric service at 2.5 cents per kw-hr., and even these are out of the running if the hours of use fall to 2000. With electric energy at 5 cents, however, even the steam engine can hold its own under German conditions. The low cost of labor is evidently a large factor in keeping down the cost of attendance on local prime movers. Under ordinary American methods of charging for energy, a 20-hp motor, such as is considered at this point, under full load for 3000 hours per year would earn so good a rate as to leave very little chance for competition, and the figures would be relatively low even under the part-load hypothesis introduced by the author.

In the larger units examined by Dr. Straus the conditions are even more favorable for the electric drive, since while seriously considering only the two most efficient of the prime movers, the Diesel engine and the locomobile, the comparison is made with actual prices charged by various German central stations for energy furnished on a large scale. These prices are based on some form of demand system of charging terminating at figures even below 1 cent per kw-hr. for large and steady users. The result of the comparison is that while for use of from 3000 to 6000 hours per year the oil engine and the locomobile, especially the latter, make a very good showing, yet both are out of the running at the prices charged, not by one, but by half a dozen, German stations. On the whole, it is very evident that under ordinary conditions of loading the electric motor at commonly obtainable prices for energy is cheaper than any local prime mover, although the small prime mover is relatively more economical under German conditions than is possible here, owing to a combination of cheap and good machinery with low-priced labor.

In dealing with larger units the heavy discounts given to a customer with a first-class load-factor tell in favor of the electric motor in spite of the low costs shown for its competitors in the larger sizes. A well-balanced demand system would seem from the data presented to have considerable advantage in dealing even with relatively small consumers. We hope the data from Dr. Straus will prove of sufficient interest to encourage some one to make a similar comparison under American conditions.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

Convention of Edison Illuminating Companies

Arrangements have been completed to hold the 1914 convention of the Association of Edison Illuminating Companies at the Greenbrier Hotel, White Sulphur Springs, W. Va. The usual reception will be held in the ballroom of the hotel on the evening of Sept. 14, and the first session will be held on the morning of Sept. 15. The business of the convention will be transacted on Sept. 15, 16 and 17, and plans are being prepared to conclude the convention with a general association dinner. The meetings will be held in the large ballroom of the White Hotel adjoining and connecting with the Greenbrier, leaving the latter entirely free for entertaining and the social life of the convention. If practicable, the active work of the convention will be confined to about twelve general papers and ten special committee reports. With one or two exceptions, the presentation of the papers and reports will be confined to a limit of twenty minutes, and those participating in the discussion will be limited as to time with the object of securing the widest participation in every feature of the convention. As is usual at all conventions of the Association of Edison Illuminating Companies, an elaborate entertainment program will be provided, but no important features of entertainment will conflict with the business sessions. Every Edison licensee in this country is now a member of the Association of Edison Illuminating Companies.

Railway Electrical Engineers at Atlantic City

The Association of Railway Electrical Engineers held its semi-annual meeting at Atlantic City, N. J., June 12. Vice-president H. C. Meloy acted as chairman and reports were read by the heads of a number of committees. Nearly 100 members were present. The report of Secretary Joseph A. Andreucetti showed a total enrolment of 514, with a treasury balance of $1,349.

The report of the committee on axle equipment, of which Mr. H. R. Bucks is chairman, related progress in collecting data in reply to inquiries sent to eighty railroads. The committee on axle belting, of which Mr. J. R. Sloan is chairman, presented a sample form of specifications for belting material, covering stitched-canvas, rubber and woven belting. Mr. L. S. Billau submitted the report of the committee on lamps, which recommends the adoption for train-lighting service of 25-34-volt lamps and 50-65-volt lamps, having nominal ratings of 15, 25 and 50 watts and 12, 20 and 40 cp, in globe bulbs. The committee also accepted (but withheld recommendation of) 15-watt and 25-watt lamps in S-17 and S-19 bulbs and 75-watt lamps in G-30 bulbs.

Mr. W. A. Del Mar, chairman of the committee on wire and cable specifications, reported that efforts will be made to adopt uniform standards corresponding with those of the American Electric Railway Engineering Association. The committee on standards, through its chairman, Mr. D. J. Cartwright, recommended the design of standard suspension lugs for generator mounting, improvement in methods of fastening battery-box doors, and more careful consideration of the requirements of car-lighting equipment in the design of trucks and brake-beams.

A paper by Mr. Edward Wray, editor of the *Railway Electrical Engineer*, Chicago, described the use of the ampere-hour meter in car-lighting service. Following an account of the elementary principles of the mercury-type meter, the author pointed out that for straight storage-battery operation the simple and differential shunt types and the resistor type of meter are best adapted, while for head-end lighting the register type of ampere-hour meter should be used. The variable-resistor meter is probably the best suited for axle-generator systems, more than 100 such equipments being already thus controlled.

Electrical Topics Before Automobile Engineers

At the annual convention of the Society of Automobile Engineers to be held at Cape May, N. J., next week (June 23 to 27), several of the papers presented will bear on electrical topics. Among these will be "Electric Transmission for Motor Cars," by Mr. Justus B. Entz, of the White company; "Ignition, Lighting and Starting Devices," by Mr. A. D. T. Libby, of the Splitdorf Electrical Company; "A General Summary of the Truck Tire Situation," by Mr. J. E. Hale, and others. Great importance is attached to the report of the electrical-equipment division, of which Mr. A. L. Riker is chairman, and to the report of the electric-vehicle division, of which Mr. A. T. Slade is chairman. The latter is formulating recommendations to be made with respect to practices concerning motors, controllers, wiring, charging appliances, tires, lamps, speed and "mileage" ratings. The membership of the society is now 1800.

Methods of Radio Transmission

At a meeting of the Institute of Radio Engineers held at the Engineering Societies Building, New York, June 3, Mr. Melville Eastham, of Boston, presented an interesting paper on the methods of radio transmission involving high group frequency and sending apparatus. He described a number of types of equipment using rotary, quenching spark-gaps, and operating on both direct and alternating current. In this method as ordinarily used a low-frequency alternating current or a direct current is employed to produce sparks recurring at a rate above the upper limit of audibility, and the very rapid groups of electromagnetic waves thus created are further subdivided into trains at audible frequencies. In this way it is said to be possible to secure higher over-all efficiency than by the common methods of conversion involving motor-generators.

Mr. Eastham also described methods of measurements involving high-frequency wattmeters operating on the dynamometer principle and gave a number of results secured by their use.

The paper was discussed at length by Messrs. Stone, Mayer, Pichon, Marriott, Simon, Hill and Hogan.

Officers of the Power Sales Club

For a number of years motor-service salesmen throughout the country have felt the need of some organization whereby the men engaged in this branch of electric-service business might be brought closer together to discuss their mutual problems and to exchange ideas. As noted in these columns June 6, the desire for such an organization culminated in the formation during the recent Philadelphia N. E. L. A. convention of the Power Sales Club. The following officers were elected to serve the club for the ensuing year: Chairman, Mr. Charles J. Russell, Philadelphia Electric Company; vice-chairman, Mr. George H. Jones, Commonwealth Edison Company, Chicago; secretary and treasurer, Mr. C. H. Stevens, Brooklyn Edison Company. Mr. Charles J. Russell, Philadelphia, was appointed chairman of the committee on organization, the other members of which are Messrs. Harvey G. Glass, H. J. Gille, J. J. Hurley, H. H. Holding, R. H. Knowlton and S. V. Walton. A committee on membership will also be named, consisting of the heads of the motor-service departments of the various central-station companies.

Chicago to Install 1000 More Street Lamps

On June 11 the board of the Sanitary District of Chicago voted to install and supply energy for 1000 more lighting units for the city. Under the terms of the original lighting contract the Sanitary District was to install and supply energy for 10,000 lamps, and this later order is an extension of the original contract, bringing the total number of lamps to 11,000. As yet it has not been definitely decided whether the new lighting units will be arc lamps or some other type of illuminant. In addition to the installation of new lamps the board has agreed to convert a system comprising approximately 1166 direct-current arc lamps and approximately 6328 old alternating-current arc lamps into an improved modern alternating-current lighting system consuming an amount of energy approximately equivalent to that used by the present system. Mr. Edward B. Ellicott is electrical engineer for the Sanitary District.

Program of Convention of Ohio Electric Light Association

The twentieth annual convention of the Ohio Electric Light Association will be held at the Breakers Hotel, Cedar Point, Ohio, July 21 to 24. President J. C. Martin will open the initial session of Tuesday afternoon with his annual address, which will be followed by reports of committees, including that on illumination, of which Mr. S. E. Doane, Cleveland, is chairman. On Wednesday morning there will be reports of the committees on meters, Mr. A. H. Bryant, Cleveland, chairman; electric transmission, Mr. M. H. Wagner, Dayton, chairman, and uniform accounting, Mr. L. K. Funkhouser, Dayton, chairman. At the afternoon meeting Dr. Thomas Darlington, secretary of the welfare committee of the Iron and Steel Institute, New York City, will lecture on "Welfare Work in Industry." On Thursday morning Mr. J. H. Mitchell, Columbus, will present a paper on motor service, and reports will be submitted by the committee on new-business co-operation, Mr. T. F. Kelly, Dayton, chairman, and by the committee on electric vehicles, Mr. M. E. Turner, Cleveland, chairman. At the afternoon session Mr. M. Luckiesh, Cleveland, will deliver his lecture on "Light, Shade, and Color in Illumination." Before the session of Friday morning the Hon. Halford Erickson, member of the Railroad Commission of Wisconsin, will speak on "Indeterminate Franchises." A number of entertainment features have also been arranged for the convention. The secretary of the Ohio Electric Light Association is Mr. D. L. Gaskill, Greenville, Ohio.

Progress of Trust Legislation

President Wilson practically assumed personal charge of the administration's proposed anti-trust legislation at Washington during the week. He declared emphatically that trust legislation shall not be sidetracked at this session of Congress. The President said that he thinks that the worst thing that can happen to business would be to keep it guessing as to what legislation is to be enacted. For this reason he said he is opposed to a plan which was formed in Washington for Congress to adjourn under a rule that would require an extra session before December at which anti-trust legislation might be passed.

Members of the House do not approve of the Newlands plan for the creation of a trade commission to which shall be granted the arbitrary right to stop any trade practices that are not fair. This was the very power which the House refused to grant in its own bill when it was under discussion. The House, to quote the words of Chairman Adamson of the interstate and foreign commerce committee, which had charge of the Covington bill, said, in effect: "This animal has no right to have any such teeth."

The Newlands amendment has gone on the calendar, where it may be called up at any time. Mr. Newlands announces that a majority of the Republican Senators supported the bill in committee, and he therefore calls it non-partisan. The important change in the amendment is an adaptation from the Stevens bill. This is the one that makes unfair practices and competition unlawful.

A protest against the inclusion of electric railways in the scope of any anti-trust legislation passed at this session of Congress was made before the Senate interstate commerce committee on June 16 by representatives of the American Electric Railway Association. At the same time a protest along similar lines for the smaller telephone companies was made by representatives of the National Independent Telephone Association.

Following his assumption of personal charge of proposed anti-trust legislation, President Wilson summoned to the White House what is known as the "steering committee" of the Senate, when the whole situation was discussed. Those present were Senator Kern, the democratic floor leader, and Senators Owen, Hoke Smith of Georgia, Thomas, O'Gorman, Martin, Newlands, Chamberlain, Clarke of Arkansas, and Culberson. As a result an announcement was made that every attempt will be made to expedite the proposed legislation, and that there is hope of finishing it by July 31. Those who are acquainted, however, with the views of some of the republican senators do not believe that adjournment will come before September.

Both the Senate judiciary committee and the Senate committee on interstate commerce are working on the bills from day to day. The judiciary committee is now attempting to perfect the Clayton interstate trade commission bill, and the commerce committee is holding hearings on the Rayburn bill.

Water-Power Legislation

For the committee on public lands, Representative James M. Graham, of Illinois, has filed a favorable report on the federal administration's water-power leasing bill. This measure is now on the calendar of the House of Representatives under a special rule for immediate disposition. Its passage seems assured before July 1, but there is little possibility that the Senate will consider it at the present session.

The bill authorizes the Secretary of the Interior to lease to citizens of the United States or properly qualified associations or corporations for a term of not more than fifty years water-power sites in the public lands of the United States, exclusive of the national parks. The Secretary is to have the power to prescribe the regulations for these leases, which are to be irrevocable except for a breach of their terms. The Secretary is to have the power of giving preference in these leases to political subdivisions, such as states, counties or municipalities. He is also authorized to grant temporary permits for one year, with extensions in certain contingencies, to enable intending applicants to investigate the possibilities of power development. The lease is to provide for speedy development and continuous operation, and a special provision is that not more than 50 per cent of the power developed is to be sold to any one purchaser without the consent of the Secretary of the Interior.

Whenever the power developed is sold outside the state of its development the regulation and control of the service, charges for service and the issuance of stocks and bonds are conferred upon the Secretary of the Interior or upon such body "as may be provided by federal statute." Similar control is given over intrastate business where there is no state public utilities commission. Combinations and agreements in restraint of trade or increase of prices are forbidden. Sale or delivery of power to distributing companies except for thirty-day periods in cases of necessity are also prohibited. Provision is made for keeping the property intact as a "going concern" at and after the time when the lease terminates. This is to be done by giving the United States the right to take over the property, upon not less than three years' notice prior to the expiration of the lease, upon payment of the actual costs of right of way, water rights, lands and interest, as well as of all structures and fixtures. This price is to be determined by mutual agreement between the Secretary of the Interior and the lessee if possible, otherwise through condemnation proceedings in the United States Circuit Court. Such "reasonable value shall not include or be affected by the value of the franchise or good will or profits to be earned on pending contracts or any other intangible element."

If the United States does not exercise this right or does not renew the lease, the Secretary of the Interior is authorized to lease the properties of the original lessee to a new lessee upon condition that the latter shall pay for the properties. Special consent of the Secretary of the Interior is necessary for contracts for power extending beyond the term of the lease. In that case the new lessees or the government will be bound by these contracts. The Secretary of the Interior is authorized to specify the rentals to be collected by the government on all power developed. These proceeds are to be paid in the United States reclamation funds, one-half of the amount is to be repaid to the treasury of the state in which the power is developed, when the reclamation fund is returned by the settlers. The states are to have these funds for educational uses or for public improvement. Municipal corporations developing power solely for municipal use may be permitted to do so without cost. Leases for the development of power not in excess of 25 hp may also be made without charges to individuals or associations for "domestic, mining or irrigation use."

The measure is to take the place of the act of Feb. 15, 1901. Concerning that act the Graham report says: "Under this provision it has been found impracticable to finance such enterprises, and the whole act was thus rendered nugatory."

The report contains the following statements: "The hearings before the committee conclusively show that over 90 per cent of the developed water-power in the public-land states is owned by twenty-eight private corporations and their subsidiaries, and that six of these control together over 56 per cent of the developed power. In addition, these same corporations own or practically control sites from which large amounts of additional power can be obtained, these sites being, as a rule, those which, because of convenience to market or cheapness of development, will be required by the economic necessities of the West for development in the near future. The Mountain Power Company owns 97 per cent of the developed power in Montana and controls nearly as much undeveloped power as it has now developed. The Utah Power & Light Company controls over 70 per cent of the power developed in Utah, and has in addition 30 per cent of the developed power of Colorado and 20 per cent of that of Idaho. And in addition it claims to have 60,000 undeveloped hp.

"While these twenty-eight companies are nominally distinct, seventeen of them are shown to be either subsidiaries of the General Electric Company or closely associated with that company through holding companies, interlocking directors and banking connections. These seventeen companies control about 60 per cent of the water-power developed by private corporations in the Western States, and this number includes four of the six companies having over 100,000 hp. Some of the remaining companies have certain affiliations with the General Electric Company and its subsidiaries, and operate in the same or adjacent territory harmoniously with them, but there is no direct evidence of General Electric control."

Strike Situation in Westinghouse Plants

Among the officials of the Westinghouse companies in the Pittsburgh district the feeling prevails that in a short time there will be a general movement on the part of a majority of the employees to return to work.

A number of the employees of the Union Switch & Signal Company left work at noon on June 12 without giving any reasons for their act. An announcement was made by the company promptly that the works would be closed until June 15, when employees would be expected to return. It is announced that practically the full number of men returned. An unsuccessful attempt was made by the strikers to induce the men at the Westinghouse foundries at Trafford City to go out on strike.

The management states that there has not been any change in its attitude with reference to importing "strike breakers," but so far it has devoted its energies toward safeguarding the valuable properties placed in its charge.

In answer to a question regarding the effect of the strike on the business of the companies, an official replied that owing to the policy adopted several months ago of manufacturing goods for stock in order to provide work for employees during the dull period, a large amount of goods, sufficient in many lines for several months' requirements, had been made and distributed

to the warehouses of the company in various parts of the country, from which orders have been filled daily without delay.

A statement giving the attitude of the Westinghouse company on the questions at issue in the strike of the employees was published in the Pittsburgh daily newspapers on June 15. It was addressed to the employees and was signed by the Westinghouse Electric & Manufacturing Company, the Westinghouse Machine Company, the Union Switch & Signal Company and the Pittsburgh Meter Company. The statement set forth that a strike was called by the officers of the Allegheny Congenial Industrial Union of the employees of the Westinghouse Electric & Manufacturing Company, followed by a walk-out in the works of the other three companies, thereby interfering with their business and preventing employees from engaging in their work. The advertisement contained the published declaration of principles of the Allegheny Congenial Industrial Union. These principles are set forth as follows:

"We affirm the irreconcilable difference of interests between the employer who buys labor power in the labor market for the purpose of making a profit, on the one hand, and the wage earner who sells his ability to produce wealth to some employer in order to secure the necessities of life, on the other. We know from bitter experience that the buyer and seller in the labor market can never see things from a common viewpoint, as the employer always buys as cheaply as possible and we as wage earners wish to sell our labor power for the highest possible wages.

"We are therefore determined to band together in an industrial union which recognizes no distinction as to craft, sex, religious creed, political affiliations, age or nationality, for the purpose of compelling our common employers to give us every concession we can force from them by industrial solidarity.

"To such an object we pledge our united effort and call upon all workers in every industry of the Pittsburgh district to join with us immediately in the organization of a great democratic union which will include every man, woman and child that works for wages."

The principles for which the Westinghouse companies stand committed are expressed as follows:

"1. Westinghouse shops shall be open shops. We stand for the principle of an open shop in which union and non-union men may work without molestation or being forced to join any organization.

"2. Westinghouse employees may or may not be members of any organization. We do not require of our employees that they shall refrain from joining labor organizations any more than we attempt to restrain them from joining any other bodies, but we maintain for all our employees the right to refrain from joining any organization without prejudice to their positions, or their security, or their comfort in our employ.

"3. The pay of skilful and productive Westinghouse employees shall not be regulated by the pay of the inefficient and less productive. We pay wages and maintain shop conditions which compare favorably with other manufacturers in our industries. By this means, and by the added inducement of steady employment, we endeavor to attract the best workmen. In order to compete with other firms, both at home and abroad, we must introduce all of the agencies by which the best efficiency is obtained. We reserve the right to determine the compensation of our employees on the basis of the service they perform for us as well as by the day rate, which measures only the time spent in our works.

"4. Every Westinghouse employee has the right of conference with the management. We receive any one employee or any number of employees from any department, or any properly chosen committee whose selection shall be truly representative from any department or of the whole body of our employees.

"5. Every Westinghouse shop shall be safe, sanitary and comfortable, and all suggestions of employees for improvement in shop conditions are welcomed by the management. We seek to maintain the best standard of sanitary and working conditions in our factories as we believe that to provide as good surroundings as the character of our operations permits is the best guarantee we have of obtaining and holding the best class of employees.

"As opposed to the principles advocated by the Allegheny Congenial Industrial Union:

"We assert that the interests of the employee and the employer are identical and that there can be no success for either party unless each recognizes the necessities of the other.

"We deny that employers and employees can never see things from a common viewpoint, and assert that the success of any business undertaking is dependent upon each endeavoring to view their common interests from the same viewpoint.

"We assert that in seeking for concessions neither party should attempt to obtain them either by force or compulsion."

Convention of the Association of Corporation Schools

At the second annual convention of the National Association of Corporation Schools, held in the new auditorium of the Curtis Publishing Company at Philadelphia, Pa., from June 9 to 12, various electrical manufacturing and central-station companies were represented. About eighty corporations are now members of this association. Dr. C. P. Steinmetz, chief consulting engineer of the General Electric Company, was elected as the new president for the ensuing year.

At the opening session held on the morning of June 9 Mr. Arthur Williams, of the New York Edison Company, the president, presided. Dr. Steinmetz spoke briefly at this session. He said that corporations are absolute necessities under present conditions; free, open competition is out of the question because the means of production are ahead of the demand and the corporations alone can so regulate production that it will be profitable. Every corporation, he said, must solve the problems of proper financing, proper administration, technical efficiency of production, and the human factor. The last is composed of two elements, namely, welfare and education of employees. Dr. Steinmetz added that up to the present time the human element has been more or less neglected, but that now corporations are taking steps to meet adequately the necessity not only of giving men good conditions in which to work but also of training them in efficiency. He spoke of the great saving of labor to the corporations by union into an association to study the subject of education. He said that the present feeling against corporations is due in a large measure to the fact that they have failed to recognize the human factor.

At the afternoon session on June 9 the chairman was Mr. C. A. S. Howlett, of the General Electric Company. The subject under discussion was salesmanship, advertising and distribution. The discussion on this subject was continued during the evening session. Mr. C. R. Sturdevant, of the American Steel & Wire Company, Worcester, Mass., said that since so much of the value of advertising depended on imagination, which was a

difficult quality to develop at the best, it was absolutely necessary to master first the known and public knowledge on the subject. Mr. F. C. Henderschott, manager of the Bureau of Education of the New York Edison Company, said that 80 per cent of the feeling favorable to public ownership is due to lack of good service rather than to high rates, and that service cannot be rendered through untrained men. A salesman who represents his company efficiently must be not only a salesman but also a business diplomat.

The session on the morning of June 10 was devoted to accounting, financing and purchasing. Among those who read papers were Mr. C. R. Sturdevant, American Steel & Wire Company, Worcester, Mass., who spoke on "Training Executives." Mr. Sturdevant said that the corporation should aid employees who were being fitted for positions of responsibility by placing at their disposal a good reference library and by having special classes for instruction.

Dr. Steinmetz, in discussing the papers read on this subject, said that executive success is to a considerable extent based not on training, education or instruction, but that there must be that inherent variation from type, individualistic temperament, which is the foundation of all such success. Mr. Louis L. Park, superintendent of apprentices of the American Locomotive Company, said that the training of draftsmen is one of the most difficult problems to meet, and that it is solved by the corporation schools. Mr. M. W. Alexander, of the General Electric Company, Lynn, Mass., read a paper on "Apprenticeship in the Mechanical Industries."

Training of Trades Apprentices

Mr. R. J. Watson, instructor in charge of trades apprentices of the Westinghouse Electric & Manufacturing Company, spoke on the training of trades apprentices. At the present time the company has 256 apprentices in the course. During the last five years there have been graduated 146 apprentices, of whom 42 per cent are still with the company. Of the total number, 15 per cent now hold executive positions, such as foremen, assistant foremen, rate men, limit setters and inspectors. Various reasons why all who were graduated did not stay with the company were assigned by Mr. Watson. Chief among these is the desire to broaden experience and become familiar with the work and conditions in other shops. Of those who leave after completion, the better will return much improved for their experience. Since the school has been in operation over 800 apprentices have been received. One-half of this number left the course or were requested to resign. Investigation shows that too much care cannot be used in the selection of the applicants. A great majority of boys do not know what a trade means except in a very superficial way. Many of those who left took up the course because some one told them that it was desirable or under compulsion of parent or guardian. At present no applicant is taken on the course until he is interviewed by the shop supervisor, the general foreman of apprentices and Mr. Watson.

Selection and Training of College Men

Mr. W. M. Skiff, manager of the engineering department of the National Lamp Works of the General Electric Company, discussed experiences in the selection and training of college men. The method which is in operation at present was inaugurated in 1906. The practice now is to take into the engineering department each year a few technical men who engage immediately in the productive work of the department and who, after having obtained a thorough foundation and understanding of the entire business as viewed from the home office departments, take up positions of responsibility in other departments and divisions of the organization. During the autumn a representative of the organization visits universities and technical schools and by prearranged program gives a talk to the classes from which it is expected men will be selected. At the time of this visit no attempt is made to obtain applications, the idea being to acquaint the men with the organization, methods, etc., with the thought that they will be stimulated to investigate the proposition as a business opening. Several of the universities in the country are using the publications of the company as textbooks on lighting. A second trip is made to the colleges shortly after the midyear examinations. This trip is made by a committee consisting of three men, one of whom is from the home office and one from the manufacturing and commercial end of the business. The home-office man continues permanently on the committee. The manufacturing and commercial members are rotated from year to year. In order that every student interested in the proposition may have the opportunity of conference for more detailed information, one or two days are spent at each university visited. When a student enters the employ of the organization, Mr. Skiff said, an effort is made to inculcate in his mind the idea that the age of dictatorial policies is passing and is being supplanted rapidly by the "part in business" policy, thus creating the feeling that he is a part of the organization and that the best interests of the organization are his best interests.

In his discussion on the "Application of Educational Methods to the Reduction of Accidents" Mr. Sydney W. Ashe, of the General Electric Company, Pittsfield, Mass., said that the practical application of the teachings of psychology to accident prevention is, after all, the surest and quickest way of curing this industrial evil, which in 1911 in this country exacted a total of 13,625 lives. Mr. Ashe gave a brief summary of a safety educational campaign which was instituted recently at the Pittsfield works of the General Electric Company with the results which have been obtained. Besides this work there is a safety committee, the chairman of which is a member of the central safety committee for the entire organization. All of the educational methods used have been for the purpose of obtaining the co-operation of the workingman himself, and it is gratifying to note that in this respect a splendid response has been secured.

In conclusion Mr. Ashe said that the experiences of the company showed that in a country like America an enormous amount can be done toward the reduction of accidents by the use of educational methods. As a final adjunct to this work he suggested a plan whereby some central association like the National Association of Corporation Schools, the American Museum of Safety or the American Red Cross would award a gold medal to every individual who performs an unusual first aid service such as resuscitating an unconscious comrade by the prone pressure method. If this extra stimulus could be given there is no question as to the increase in stability which it would bring to the whole safety movement.

The subjects of vocational guidance and welfare work, physical efficiency, hygiene and sanitation were considered at the session on the afternoon of June 12. Mr. T. H. Bailey-Whipple, of the educational department of the Westinghouse Electric & Manufacturing Company, acted as chairman, in place of Mr. C. R. Dooley, secretary of this department. Mr. J. C. Robinson, financial secretary of the Employees' Association of the New York Edison Company, read a paper on the relations of this company and its employees. Dr. William H. Tolman, director of the American Museum of Safety, presented an address on "How to Prevent 50 Per Cent of

the Accidents." He said that the modern committee of safety, with the safety engineer and his specialized knowledge at its head, forms an important part of almost every large corporation. The policy of prevention instead of compensation is gradually allowing the old figure of the claim agent to evolve into the larger position of safety engineer and to embrace the wider field of claim prevention.

Importance of Good Health Campaign

Dr. C. A. Lauffer, medical director of the Westinghouse Electric & Manufacturing Company, presented a paper on "Standardized First Aid." The approved first-aid package is a glass container which is inclosed in a felt-lined metal box. Dr. Lauffer expressed the opinion that the good health campaign is more productive of results in the line of accident prevention than much additional safeguarding of machines. Extensive observation leads to the belief that fatigue is the underlying cause of most of the industrial accidents.

Exhibits showing the methods employed in education were made by the Westinghouse Electric & Manufacturing Company, the General Electric Company, the Western Electric Company, the New York Edison Company, the Chicago Central Station Institute, the National Commercial Gas Association and others.

The Design of Illuminated Signs

Before a joint meeting of the Electrical Section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers, June 10, Prof. A. H. Ford, of Iowa City, presented a paper entitled "The Design of Electric Signs," setting forth the laws governing the legibility of illuminated signs and the method of design which produces legibility at any predetermined distance. After a discussion of his investigations and research to determine visual acuity the speaker stated that the maximum possible acuity is about 2000 measured as the ratio of the distance from two parallel lines at which they appear as separate lines to the distance between them. Curves plotted from data obtained showed that there is a marked change of visual acuity as the intrinsic brilliancy of the filament varies. In explanation of this fact it was said that wherever two images of parallel lines are formed on the retina the lines appear as one unless the images are far enough apart to leave a row of retinal cones unstimulated between them. When stimulus is intense the effect is apparently not confined to cones upon which the image falls, but spreads to adjacent cones.

Design of Solid Letter Signs

In designing solid letter signs with dark backgrounds the most important rule to follow, said the speaker, is that the distance between the letters and the elements of the individual letters must be greater than the maximum distance at which the sign is to be read, divided by the visual acuity for the letter luminosity used. During tests a curious effect noted in solid letter signs was that as the luminosity increased the distance of legibility first increased and then decreased to a fairly definite minimum. Low luminosity, it was decided, is best as compared with current practice for signs of this type.

The Point-Letter Sign a Problem

A designer of point-letter signs must keep the distance between the separate letters and parts of the same letter greater than the distance to the observer, divided by the visual acuity for two bright lines when the observer is at the maximum distance at which the sign is to be read; at the same time the distance between lamps on each letter must be less than the distance to the observer divided by the visual acuity for two bright points when the observer is at the minimum distance at which the sign is to be read. Considering these limits the speaker concluded that point-letter signs made of illuminated bull's-eyes are ordinarily more legible than those made of exposed lamps.

Selecting the combination sign as the most desirable for ordinary use, the writer suggested solid letters for the legend, with a border of bright lamps where it is desirable to attract attention by means of the brilliancy of the sign. In such signs spaces between the letters or parts of the same letter should be greater than the distance to the observer divided by 1000 when the observer is at the maximum distance at which the sign is to be read. From the standpoint of legibility the speaker contended that the next best sign is one with trough-shaped letters equipped with bowl-frosted lamps.

Discussion

In the discussion of the paper, Mr. R. E. Cleveland, of the National Lamp Works, Cleveland, Ohio, reported that he had been conducting similar tests on signs, keeping in view the commercial problems of the sign manufacturers. Although it may be true that certain types of signs are most legible, their inability to attract attention might eliminate them from the category of successful advertising media.

Mr. L. G. Shepard, Federal Sign System (Electric), said that Professor Ford's data bore out a common rule in use among sign makers to the effect that a 6-ft. letter should be legible at a distance of 1 mile.

Dr. Harry Gradle, speaking of the distance between sign letters, said that an electric sign to be successful should be entirely readable without too great motion of the eyes.

Chicago Street Lighting

The second paper of the evening, "Chicago Street Lighting," by Mr. P. E. Haynes, of the City Bureau of Electricity and Gas, was read by Mr. W. R. Matheny. Data presented showed that there are now approximately 19,000 arc lamps in use in Chicago, and there are 4000 tungsten units illuminating railroad subways, in addition to the city's ornamental tungsten and gas-lighting units.

Those who spoke in the discussion were Messrs. A. J. Sweet of Milwaukee, and J. R. Cravath, F. H. Bernhard and H. Schaedlich of Chicago. The speakers brought out the point that the experimental high-efficiency gas-filled lamps now operating on arc-lamp circuits appear to be remarkably successful.

The letter ballot on officers for the Chicago Section of the A. I. E. E. resulted as follows: Chairman, Mr. E. W. Allen; secretary, Mr. W. J. Norton; member of executive committee for three years, Mr. D. W. Roper.

Annual Report of Pacific Gas & Electric Company

The eighth annual report of the Pacific Gas & Electric Company, containing forty-five pages, covers operations during the year 1913 and also gives much general information in regard to the property. It is signed for the directors by Mr. Frank G. Drum, the president.

The company does approximately 36 per cent of the gas and electric business of the entire State of California and ranks as one of the four or five largest corporations of its kind in the United States. During the year 1913 the gross earnings of $16,202,337 were divided as follows: Sales of electric energy, $8,230,782, or 51 per cent; gas, $6,547,594, or 40 per cent; Sacra-

the Wichita Falls (Tex.) Traction Company was recently operated through the streets of the city without trolley connection or other source of supply. The battery used employs carbon and zinc with a secret solution which, like the zinc, must be renewed at intervals. Messrs. Julius J. Krohn and John McGivney are the inventors. On its trial trip the car carried thirty-five persons, but had to be helped over some of the grades by a trolley car.

* * *

EXAMINATION FOR STEAM ENGINEER.—The United States Civil Service Commission will hold an open competitive examination on July 8 for first-class steam engineer. The usual entrance salary of this position is $1,200 a year. Competitors will be examined in practical questions in mechanical and electrical engineering, comprising the construction and operation of the heating plant and electric lighting and elevator machinery in first-class public buildings, and will be required to write a letter on some mechanical or engineering subject. Training and experience will count twenty-five weights. Persons desiring to take this examination should write for Form 1312 of the United States Civil Service Commission, Washington, D. C., stating the title of the examination for which the form is desired.

* * *

LIGHTING SUBWAYS AT ELEVATED TRACK CROSSINGS.—Mr. Ray Palmer, commissioner of gas and electricity for the city of Chicago, has completed arrangements with the steam-railroad companies in Chicago by which the plan of standard lighting for the subways under the elevated tracks at street crossings, as worked out by the Department of Electricity, will be carried out. The contract involves the lighting of 830 subways, the railroads agreeing to pay for 410 of these and the city for 420. Incandescent electric lighting will be used, the units being 25-watt lamps. The number of lamps required for each subway will vary from two or three to possibly 100, depending on the size of the subway. The average number of lamps to a subway will be about sixteen. Electrical energy will be furnished by the Sanitary District of Chicago and the Commonwealth Edison Company.

* * *

SOCIETY MEETINGS

AMERICAN ELECTROCHEMICAL SOCIETY.—The fall meeting of the American Electrochemical Society will be held at Niagara Falls, N. Y., Oct. 1, 2 and 3. The secretary of the society is Dr. Joseph W. Richards, Lehigh University, South Bethlehem, Pa.

* * *

ELECTRICAL CREDIT MEN'S CONVENTION.—The fifteenth annual convention of the National Electrical Credit Association will be held at the Hotel Statler, Buffalo, N. Y., on June 27, beginning at 10 o'clock. Mr. F. P. Vose, Marquette Building, Chicago, is the secretary of the association.

* * *

JOVIAN ACTIVITIES AT LOUISVILLE, KY.—Mr. R. E. Brian was elected president of the Jovian League of Louisville at the recent June meeting held in the Tyler Hotel. Mr. Robert Montgomery was chosen vice-president and Mr. Carl A. Klemm was elected secretary. Messrs. James Clark, Jr., and W. O. Smith were added to the board of directors. The July meeting of the league will take the form of an outing at Senning's Park, Louisville.

* * *

JOVIAN LEAGUE OF SOUTHERN CALIFORNIA.—The luncheon of the Jovian Electrical League of Southern California, which was held on June 3 at Christopher's, brought forth an attendance of 100 members and guests. Mr. J. C. Rendler, chairman, introduced the speaker, Mr. Edward A. Regan, former Assistant United States District Attorney, who discussed "General Organization," referring in particular to the evident spirit of co-operation which exists throughout the electrical industries and interests of Southern California as plainly exemplified by the attendance at and interest shown in the meeting.

* * *

PITTSBURGH SECTION OF E. V. A. FORMED.—A Pittsburgh Section of the Electric Vehicle Association of America was organized on June 11 at a meeting held in Pittsburgh, Pa., under the auspices of the Pittsburgh Electrical Association. The new branch consists of about thirty members interested in electric automobiles and commercial vehicles. The organization was effected through the efforts of Messrs. Albert Jackson Marshall, executive secretary of the National Association, and Charles A. Ward, secretary of the Ward Motor Vehicle Company, New York. The executive committee of the Pittsburgh Section consists of Messrs. W. A. Donkin, chairman; M. V. Schoef, vice-chairman, and Joseph A. Jaques, secretary. Among those who spoke at the organization meeting were Messrs. Henry Harris, of the Duquesne Light Company, Pittsburgh, and Clarence Van Brandt, of the Exide Storage Battery Company, Philadelphia.

* * *

EVENING MEETING OF CHICAGO ELECTRIC VEHICLE MEN.—The meeting of the Chicago Section of the Electric Vehicle Association of America on June 10, the first to be held under the direction of the new officers, Chairman W. J. McDowell and Secretary F. E. McCall, took the form of a dinner meeting instead of the usual luncheon. Mr. George H. Jones and Mr. Homer E. Niesz, Commonwealth Edison Company, and Mr. C. B. Frayer, manager of the Edison Storage Battery Company, made short talks concerning the interest shown in the electric vehicle at the recent Philadelphia convention. The speech of Dr. Steinmetz, as reported in the *Electrical World* of June 6, was read by Mr. Niesz, and was received with enthusiasm. In the routine business of the evening the following were appointed as committee chairmen: Programs and papers, Mr. L. E. Wagner; membership, Mr. C. B. Frayer; garage, Mr. Harry Salvat; orphans' day outing, Mr. Homer E. Niesz, and traffic regulation, Mr. D. C. Arlington.

* * *

CANADIAN ELECTRICAL ASSOCIATION CONVENTION COMMITTEES.—For the twenty-fourth annual convention of the Canadian Electrical Association, which will be held in Montreal, Canada, from June 24 to 27, at the Ritz-Carlton Hotel, the local committees are as follows: General committee, Major Hutcheson and Mr. J. S. Norris, joint chairmen, and Messrs. L. D. McFarlane, E. F. Sise, G. H. Olney, R. S. Kelch, R. J. Jones and J. M. Robertson and Dr. L. Herdt; ways and means committee, Mr. Julian C. Smith, chairman, and Messrs. K. B. Thornton, J. A. Shaw, R. H. Balfour, W. F. Graves and R. F. Morkill; entertainment committee, Mr. Lawford Grant, chairman, Alderman Boyd and Messrs. Paul Sise, R. G. Harris, W. C. Lancaster, W. H. Winter, H. C. Post, R. Roper, H. C. Powell and R. M. Wilson; publicity committee, Mr. S. W. Smith, chairman, and Messrs. W. J. Doherty and L. J. Belknap; finance committee, Mr. J. W. Pilcher, chairman, and Messrs. C. F. Medbury, F. W. Smith, R. M. Wilson and L. B. Belknap; honorary secretary, Mr. P. T. Davies. A special program has been arranged by the entertainment committee.

Plant of the Salmon River Power Company—II

General plan and features of design which are peculiar to the transmission end of this new and interesting hydroelectric installation

IN last week's issue of the *Electrical World* the hydraulic and electrical generating equipment of the new power plant of the Salmon River Power Company, near Altmar, N. Y., was described, together with the history of the development of the project. The following paragraphs cover the transformers and control apparatus and the transmission line connecting the plant with the remainder of the system of the Niagara, Lockport & Ontario Power Company.

Transformers

The main transformers are water-cooled, and each set of three is star-connected on the high-tension and delta-connected on the low-tension side. Each has a weight of approximately 27 tons complete, made up as follows: Core and coils, 15.5 tons; oil, 5 tons, and case, 6.5 tons. Like the generators, the transformers are designed for high efficiency at light load, the full-load copper loss being 30.8 kw and the core loss 16.7 kw. The specified regulation is 1.55 per cent at full load and 100 per cent power-factor, and 4.15 per cent at 85 per cent power-factor.

The transformer cases are mounted on flanged wheels rolling on tracks, this mounting permitting the bringing of the transformers into the field of the crane. The usual provisions are made to drain the cases of oil and to clean and dry the oil. Three 100-kw self-cooled transformers are used for general service about the plant, stepping the voltage down from 6600 to 220. These are delta-connected on both sides.

Auxiliary Apparatus

The busbars, circuit-breakers, control switchboard, etc., are placed in galleries at one side of the turbine room and in the small bay already referred to. The high-tension busbars, which are in duplicate, are hung directly from the roof, and a row of disconnecting switches is mounted just below them, a switch as well as a circuit-breaker being in each line on the line side and on the transformer side. The line and transformer circuit-breakers are on the upper gallery, and all connecting wires are No. 0000 hard-drawn trolley wire, which is of sufficient stiffness to avoid the necessity of many supports. On the lower or main floor under the gallery are the generator circuit-breakers, the main and service transformers, the service circuit-breaker structure, the storage battery for switch operation, the oil storage, cleaning and drying equipment and auxiliaries.

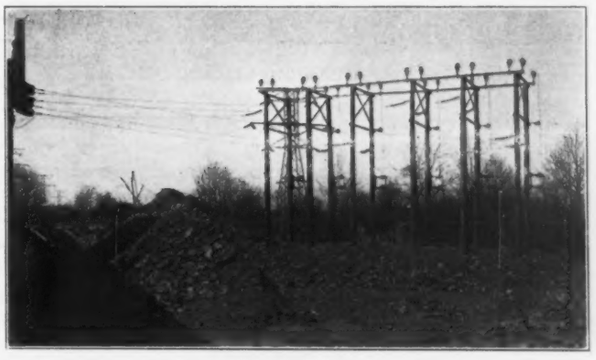


FIG. 11—LIGHTNING ARRESTERS AND TERMINAL STRUCTURE AT POWER HOUSE

The feeder bay, referred to before, has two floors, the lower of which contains the superintendent's office and the control switchboard. The switchboard is of the vertical panel type. It is, of course, quite remote from the turbine room. Above the switchboard room is the line entrance chamber with choke coils and line "disconnects."

Without going into detail of switchboard layout, it may be said that the general plan is as follows: For each generator there is one panel containing control apparatus for a generator, its exciter and its transformer bank, and an auxiliary recording meter and relay panel. The main panel contains a polyphase indicating wattmeter, a polyphase power-factor meter, a Tirrill regulator, ammeters, voltmeters, a drum-type,

FIG. 10—60,000-VOLT TRANSFORMERS AND CIRCUIT-BREAKERS

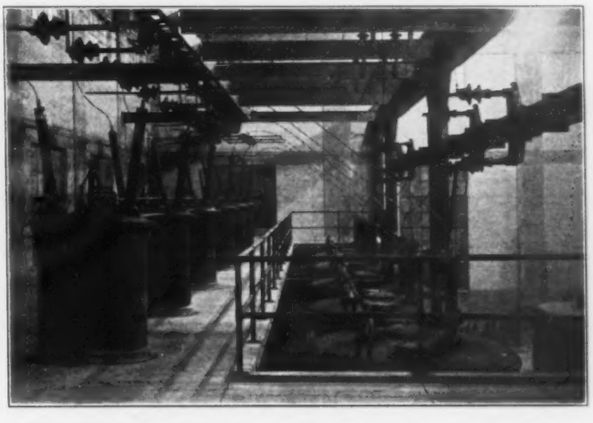


FIG. 12—60,000-VOLT TRANSFORMERS AND CIRCUIT-BREAKERS

oil-switch controller and the usual synchronizing plugs, indicating lamps and field-current controllers. On a swinging bracket are a frequency meter and a synchroscope. Each generator panel also contains a controller for the water-wheel governor and another for the 0.5-hp hydraulic valve control motor and indicating lamps to show the position of the hydraulic valve plunger. On

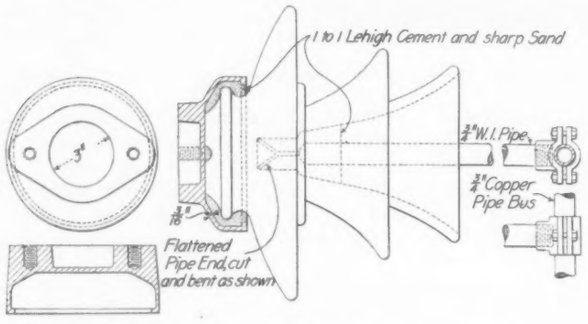


FIG. 13—HIGH-TENSION BUSBAR INSULATOR

each auxiliary panel is a polyphase watt-hour meter, a graphic polyphase wattmeter, reverse-power relays with selective relays, reverse-power relays without selective relays for overload and reverse power and connected to trip both the 60,000-volt and 6600-volt circuit-breakers, together with the necessary relay switches, and an instantaneous no-voltage relay.

There is one 60,000-volt, three-phase feeder control panel with an auxiliary relay panel equipped for two 30,000-hp lines. An ammeter is provided for each line wire, and there are the necessary oil-switch controllers and indicating lamps. Finally there are two service panels, one for direct current and the other for alternating current. These have standard equipment.

The relation of all these switches, instruments, etc., will be evident from the accompanying diagram of electrical connections.

The high-tension line circuit-breakers are of the 110,000-volt, triple-pole, single-throw reactance type of 300-amp rating.

The Transmission Line

The line which connects the generating plant at Bennett Bridge with the substation of the Niagara, Lockport & Ontario Power Company at Solvay, near Syracuse, is approximately 42 miles long and comprises two circuits.

The line conductors are of No. 0000 seven-strand-cable, hard-drawn copper. The elastic limit of this is not less than 35,000 lb. per square inch and the ultimate strength 50,000 lb. Permissible elongation in 10 in. is not less than 1.5 per cent and as nearly 2 per cent as possible. Conductivity is at least 98 per cent of Matthiessen's standard. The lines are protected for a distance of a few miles at each end by three ground wires, and for the rest of the way by two ground wires. These ground wires are of galvanized Siemens-Martin steel strand. A telephone line of ¼-in. copper-clad steel is carried directly on the transmission towers.

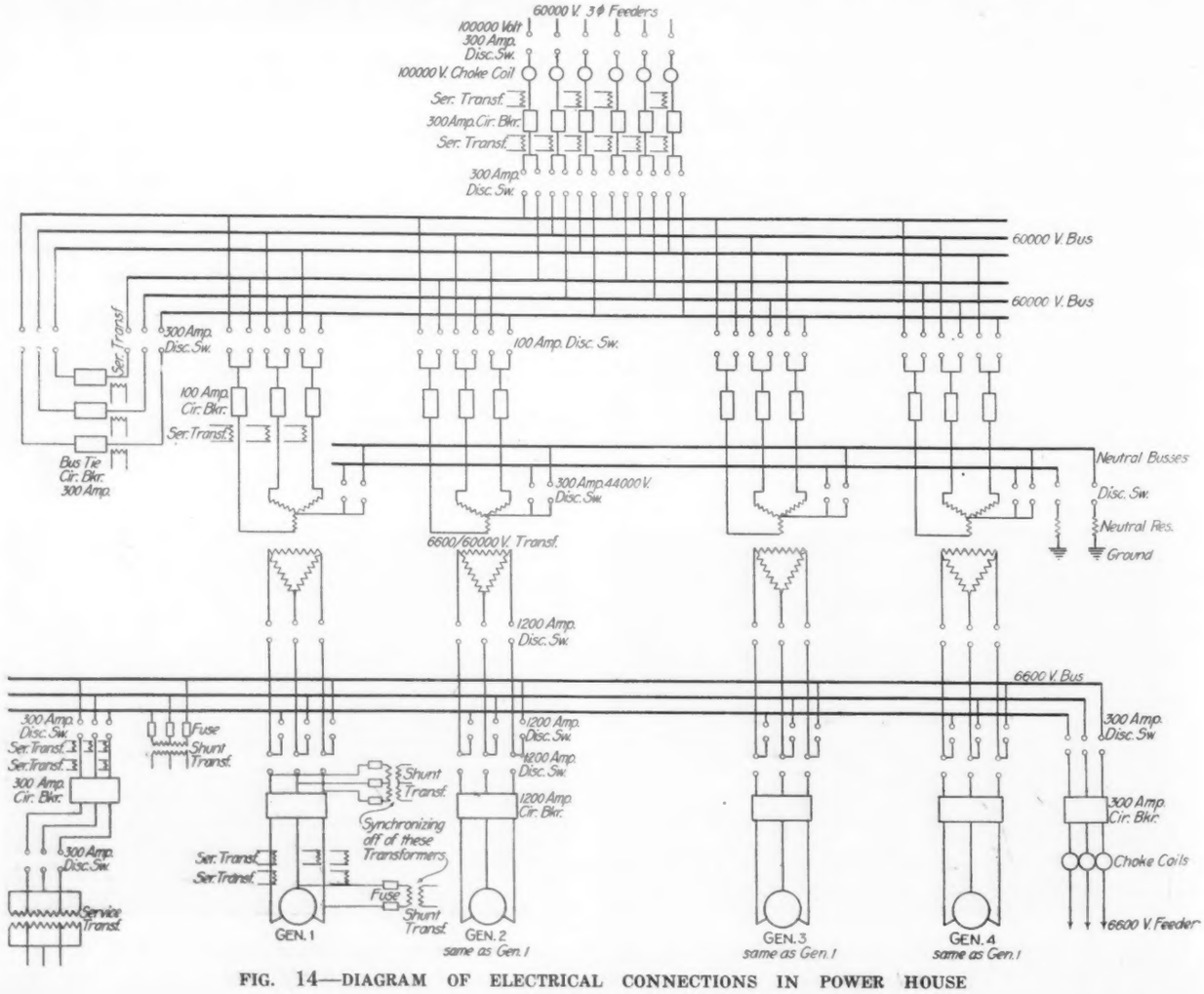


FIG. 14—DIAGRAM OF ELECTRICAL CONNECTIONS IN POWER HOUSE

Starting at the line circuit-breaker (see Fig. 14) each line wire first includes an oil-immersed choke coil, passing thence to a disconnecting switch mounted high in the terminal chamber. The wall entrance is through a 36-in. tile set in the wall at an angle and containing a concrete diaphragm supporting a multi-sleeve porcelain bushing.

Outside the power plant is a structure built up of 50-ft. wooden poles and cross-arms and serving several purposes. It acts as an angle and strain tower, taking up all line tension and starting the line off in the proper direction. The topography of the station site is such as to make this necessary. It carries the horn-gap arresters and fuses which furnish the lightning protection for the station, keeping this apparatus at a suitable distance from the latter. Each line wire is attached to the station wall by two strings of insulators set at an angle thereto, to prevent swinging of the entrance wire, and to the angle tower by a single string at each of two points.

Each lightning arrester consists simply of two electrically parallel, grounded horn-gaps, one longer than the other. The shorter gap is grounded through a fuse.

The Salmon River line is to be tied in with the Niagara Falls plant of the Ontario Power Company, acting in general as a source of energy but occasionally as a synchronous condenser plant. Towers of greater strength than is usual for such lines were installed. The specifications called for the following test load strength: For the standard towers, a load of 4000 lb. applied in a horizontal direction at any one of the conductor or ground-wire supports, or a horizontal load of 12,000 lb. applied at the center of the tower at the middle cross-arm, or a vertical load of 2000 lb. applied at any insulator or ground-wire support, should not produce failure or permanent distortion of any member. For the strain towers of standard type the corresponding figures are 4000 lb., 30,000 lb. and 2000 lb. The towers are heavy, not only on account of the great strength called for, but also because a very liberal allowance was provided for clearance to prevent the line wires from swinging together. The standard towers are designed for spacing ten to the mile.

The towers are of the square, rigid type, the arrangement being as shown in the accompanying diagrams. The height of the standard tower is 44 ft. to the point of support of the lowest insulator, and provision was made for extensions to be applied to the bases to raise some towers from 10 ft. to 20 ft. higher. While the insulators are placed in general one above the other, the middle one is offset. The vertical distance between cables is 8 ft., and the middle one on each side projects beyond the uppermost and lowest a distance of 6 ft.

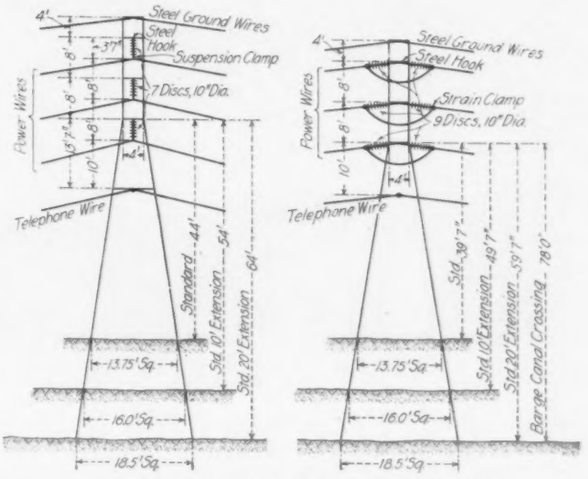


FIG. 16—STANDARD TOWER DIMENSIONS

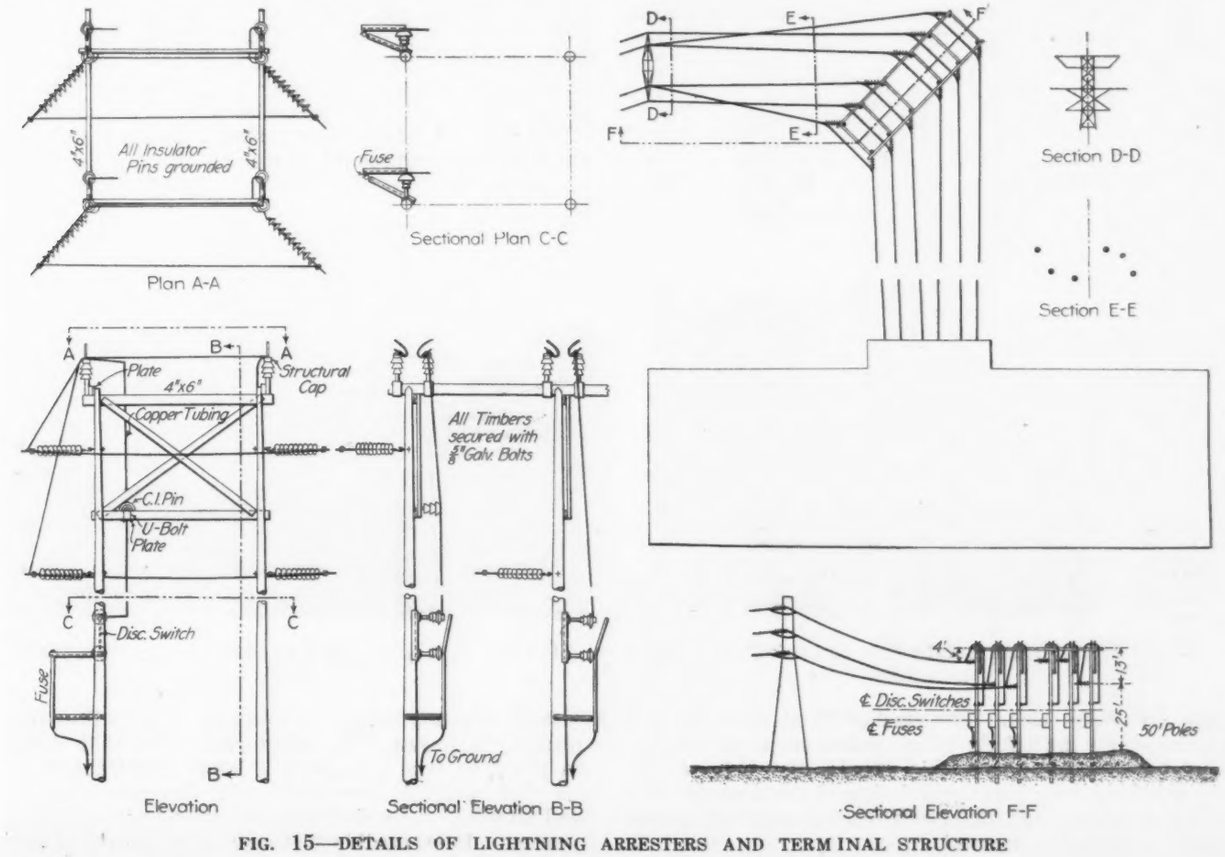


FIG. 15—DETAILS OF LIGHTNING ARRESTERS AND TERMINAL STRUCTURE

The towers carry four cross-arms. The top one is for the ground wires and below it are two short arms and one long one, all carrying strings of insulators at both ends. (See Figs. 16 to 21.) Approximately one-fourth of the towers are strain towers, and there are several special towers constructed to comply with the

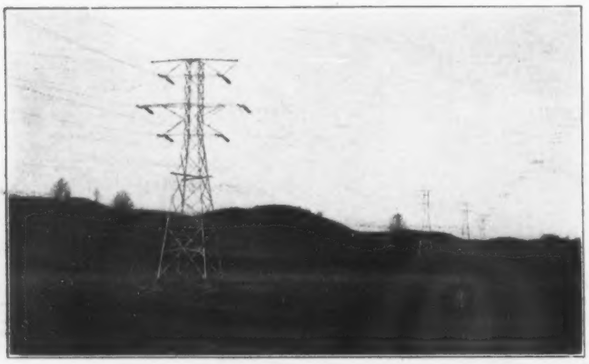


FIG. 17—STRAIN TOWER

regulations of the steam railroads which have to be crossed. The parts of the tower are galvanized after manufacture and all bolts, nuts, washers, clamps and other small parts are sherardized.

All of the footings for the standard towers are of structural steel shapes, galvanized and provided with holes for the attachment of timber or other structures for adaptation to special conditions.

Special Design and Operating Features of the Plant

From the above description it is evident that the plant of the Salmon River Power Company is unusual in a number of particulars. It is designed to operate in a parallel with a plant six times as large as itself, situated 200 miles away by transmission line. Its characteristics must be such that it will carry a proper pro-

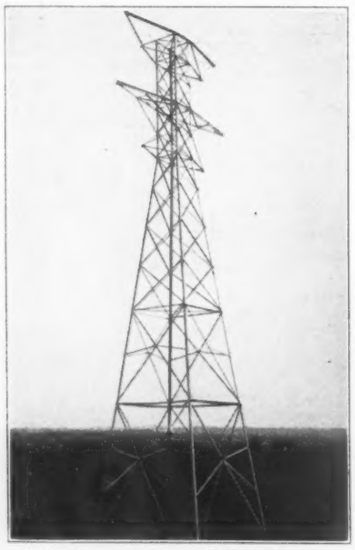


FIG. 18—TOWER NEAR ROCHESTER, SYRACUSE & EASTERN RAILROAD

portion of the load. The smaller plant must be protected from the effects of excessive loads on the line and of short-circuits within itself. For this reason, as will have been noted, the design of the generators is such that they will not be injured by any attempted draft of excessive current.

From the operating standpoint the design of the plant involved studies of the following features: (1) The kilowatt rating of the plant in relation to the stream flow and the load characteristics, to the end that its output might be utilized to the best advantage. (2) The speed regulation of the plant, to the end that it

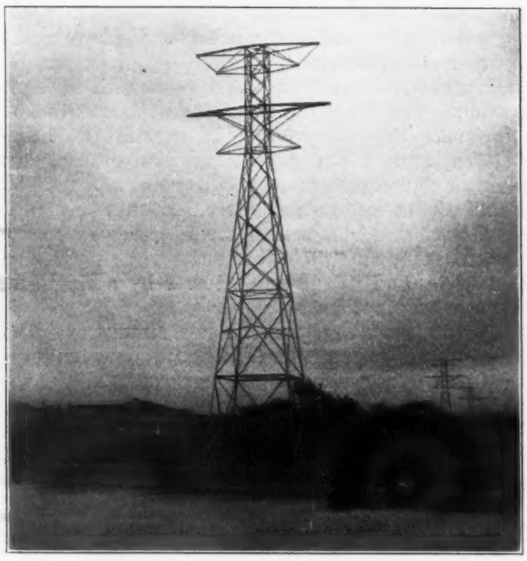


FIG. 19—ERIE CANAL CROSSING

should take its share of both slow and rapid load variations. (3) The regulation of the voltage of the plant, to the end that it should give a uniform voltage at any desired point on the transmission system. (4) Provision for utilizing the plant for power-factor regulation in the line and, when it is not carrying active load for one reason or another, for using it as a great synchronous condenser to draw leading current and thus improve the power-factor of the load on the Niagara Falls plant. Some of the interesting features adopted as a result of these studies are as follows:

The heavy flywheels were installed on the generating units for the purpose of increasing the flywheel effect of the rotating parts to a value equal to that of the

FIG. 20—TOWER LINE NEAR LINE OF N., L. & O. TRANSMISSION

units at Niagara Falls. The energy storage thus provided, by improving the speed regulation, will enable the plant to take its share of momentary overloads. For the present the load will be regulated by hand on telephone orders from a central point such as Syracuse. It is possible that automatic control of load

will be provided later. For the purpose of improving the operation of the generators as synchronous condensers, amortizing windings were provided in the pole faces.

As the plant is to be operated at considerable distance from its load, the regulation of voltage has to be

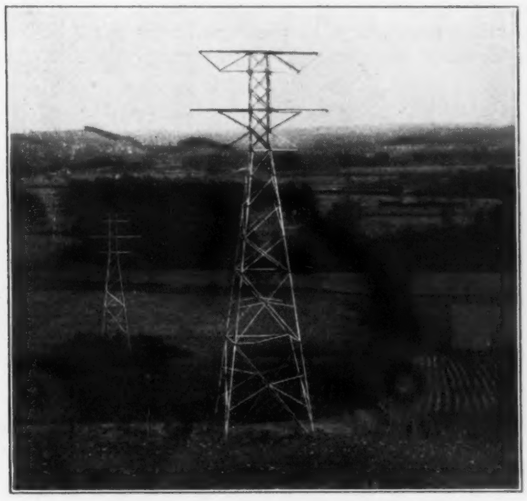


FIG. 21—VIEW OF CROSS-COUNTRY LINE OF TOWERS

made with the requirements of the distant point in view. For this purpose the Tirrill regulators which are installed on each generating unit are operated in conjunction with a line compensator. A special scheme has been worked out by the company's engineers in which a series transformer with three windings is utilized for compensation. Two of the windings have variable numbers of turns, the adjustment being made by means of rheostat face plates. The remaining winding on the transformer is connected to the compensating coils, which form part of the Tirrill regulator.

With the regulator thus connected, when the two adjustable primary coils of the series transformer are connected respectively to the secondaries of current transformers in two of the three line wires, the compensating coils produce an effect in the regu-

FIG. 22—CONCRETING FOOTINGS FOR SPECIAL NEW YORK CENTRAL CROSSING

lator dependent upon the current in the two line wires and therefore proportional to the line drop. The numbers of turns in the primary coils are adjusted to give the desired degree of compensation. By manipulating the levers controlling the numbers of primary turns both relatively and absolutely, both the phase and the magnitude of current in the third winding can be controlled. Once set, the apparatus will regulate for any given compensating condition.

The plant will contain four generators, which will be operated in parallel with separate Tirrill regulators. This desirable method of operation necessitates and is

FIG. 23—EXCAVATION FOR FLOATERS, CICERO SWAMP

made possible by power-factor compensation to prevent interchange of current between generators. Such power-factor compensation is provided in accordance with the following simple plan: The alternating-current coil in the Tirrill regulator is provided with current from a circuit in which is the secondary of a shunt transformer with its primary winding connected across two terminals of the generator. In the regulator circuit is also a resistor connected across the secondary of a series transformer in the third leg of the generator winding. When the generator is supplying a unity power-factor load the two components of the electromotive force thus produced in the alternating-current regulator coil are in quadrature. When the power-factor varies from unity the electromotive force produced by the quadrature current has a rapidly increasing component in phase (or opposition) with the main electromotive force, thus causing the regulator immediately to restore the unity power-factor condition. The same system of connections works equally well when

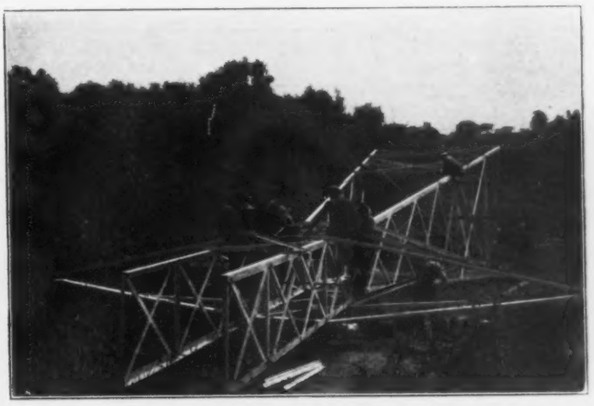


FIG. 24—WORKMEN EMPLOYED IN ASSEMBLING TRANSMISSION-LINE TOWER

the load is at other than unity power-factor (within limits), except that a slight compounding effect due to load variation is magnified. By setting the apparatus to divide the wattless current properly among the generators at one load, the adjustment holds for other loads.

Among other provisions for insuring satisfactory operation, we may mention the extra insulation of that portion of the station wiring directly exposed to line conditions from the line entrance to and including the line terminals of the choke coils. The insulation is designed for 110,000 volts so that failure is no more likely to occur here than on the line. The high-tension busbars are duplicate.

Provision has been made for grounding the neutrals of the generators in the station, but the desirability of doing so is still under discussion. The transformer neutrals have, however, been grounded through high resistance.

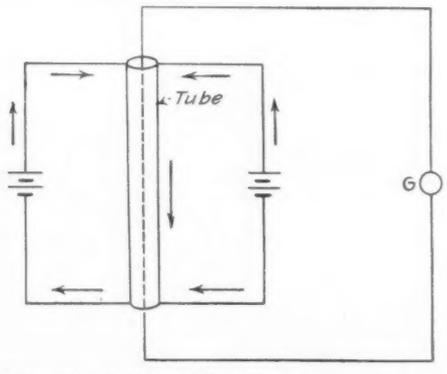
The generators in the new station are synchronized on the low-tension side by means of three shunt transformers. Two of these are connected to the circuits on one side of the oil circuit-breaker and are used for the instruments and relays. On the generator side of the circuit-breaker is a special shunt transformer for voltmeter, regulator and synchronizer. The arrangement of synchronizing apparatus is suggested in the accompanying electric circuit diagram. (See Fig. 14.)

Engineering Direction of the Plant

The engineering of the plant as described in the foregoing article has been under the direction of Mr. V. G. Converse, chief engineer of the Salmon River Power Company. Barclay, Parsons & Klapp had charge of the engineering and construction of the dam and acted as consulting engineers for the entire work. The plant was put into operation on April 10, 1914, and is now operating with entire satisfaction, carrying daily a maximum of 15,000 kw. Two units are now in operation and the third and fourth are in process of installation.

An Electromagnetic Puzzle

A conducting tube forms the return circuit as shown for two sources of emf, making a symmetrical arrangement of conductors with the tube as the central common path. The magnetic flux in such a tube is everywhere zero, and yet if the tube be threaded with a wire having its ends connected to a galvanometer and the flow of current be interrupted or restored in the tube, an induced emf will be indicated by the galvanometer,



MAGNETIC INDUCTION OCCURRING IN A FIELD OF ZERO FLUX

according to Prof. F. J. Rogers, of Princeton University, who submitted this phenomenon to the American Physical Society, at its Washington meeting, as "an electromagnetic puzzle." From his own experiments Professor Rogers reports that he found the induced emf to be proportional to the length of the conductor tube inclosing the galvanometer circuit.

COMMUTATION—I

By Alfred Still

MUCH valuable experimental work has been done in the investigation of commutation phenomena, and the amount of printed matter treating of the theory of commutation constitutes an important percentage of the formidable mass of literature devoted to electrical-engineering subjects. Not-

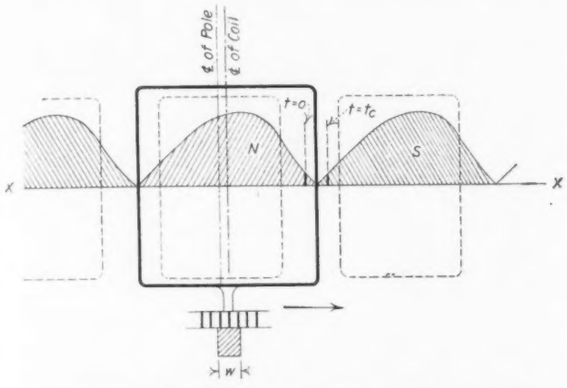


FIG. 1—COMMUTATED COIL IN NEUTRAL ZONE

withstanding this vast store of experience and knowledge, papers and articles dealing with various aspects of commutation still continue to be read and written. Clearly, the subject is not yet exhausted; yet the manufacturer of dynamo-electric machinery is ever ready to declare that during the last twenty years he has experienced no difficulty in producing machines to run absolutely without sparking, the impression produced on the buyer being that he, the manufacturer, prefers to sell a machine with a commutator rather than one which does not require this addition. This is an impression which may well be based on fact, seeing that the commutator quite appreciably enhances the price of the machine. The user, on the other hand, appears to be sceptical of the good qualities and behavior claimed for the commutator and brush gear; and, although as a general statement it may be said that his troubles—when they occur—are not infrequently due to his carelessness or fault rather than to defective design, yet, from the impartial point of view of those who are neither manufacturers nor operating engineers, it does seem that troubles due to commutation are not entirely imaginary or of merely historic interest.

The present writer might deem it necessary to apologize for presenting yet another article on the phenomena of commutation in continuous-current machines were it not that he believes it possible to put the fundamental principles involved into a somewhat simpler form than they usually assume when clothed in mathematical symbolism or when—as is not infrequently the case—the writer himself is embarrassed by his inability to obtain a clear mental conception of the physical phenomena he writes about.

Before the publication of Mr. Lamme's paper[1] the methods of Dr. Steinmetz[2] and Dr. E. Arnold[3] formed the nucleus around which the bulk of our commutation literature clung. Mr. Lamme's paper has the great merit of putting the more or less familiar problems of commutation in a new light. The end he attains is approximately the same as that attained by any other

[1] "A Theory of Commutation and Its Application to Interpole Machines," by B. G. Lamme. *Trans.* A. I. E. E., Vol. XXX, pp. 2359-2404.

[2] "Theoretical Elements of Electrical Engineering."

[3] "Die Gleichstrom-Maschine."

reasonably accurate method of analysis, provided all factors of importance are included, and the difficulties he encounters are of the same order and magnitude as those encountered by other investigators, but by getting nearer to the true physical conditions in the zone of commutation he saves us from drifting, sometimes aim-

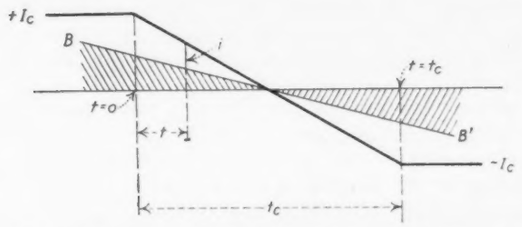


FIG. 2—RELATION BETWEEN SHORT-CIRCUIT CURRENT AND MAGNETIC FLUX IN COMMUTATION ZONE

lessly, on a sea of abstract speculation. Although the present article has undoubtedly been suggested by the reading of Mr. Lamme's paper, yet its aim is not so much to furnish additional material for the designer as to give the student a clear conception of the phenomena of commutation. The writer's end is simplicity or clearness, even if the less important factors are entirely ignored, while, in Mr. Lamme's own words, his method of analysis, including as it does more conditions than are usually included, "instead of making the problem appear simpler than formerly . . . makes the problem appear more complex."[4]

In the first place, it may be stated that considerations of a mechanical nature, such as vibration, uneven or oily commutator surface, insufficient or excessive brush pressure, etc., cannot even be touched upon in the space of this article, and, in the second place, ideal or "straight-line" commutation will be assumed, and the conditions necessary to produce this—generally desirable—result investigated, in order that a multitude of more or less arbitrary assumptions may not obscure the problem in its early stages. By working from the simplest possible case to the more complex it is thought that the object in view—a physical conception of commutation phenomena leading to practical ends—will best be served, and influencing factors of relatively small practical importance will be either disregarded or but briefly referred to.

Consider a closed coil of wire of T turns moving in a magnetic field. At the instant of time $t = 0$ the total flux of induction passing through the coil is $+\Phi_o$ maxwells, and at the instant of time $t = t_c$ seconds, the total flux through the coil is $+\Phi_c$ maxwells. Then on the assumption that the flux links equally with every turn in the coil, the average value of the emf developed in the coil during the interval of time t_c is

$$e_m = \frac{(\Phi_c - \Phi_o)\ T}{t_c \times 10^8} \text{ volts.}$$

If r is the ohmic resistance of the coil and e is any instantaneous value of the emf produced by the cutting of the actual magnetic field in the neighborhood of the wire, the instantaneous value of the current in the coil is $i = \frac{e}{r}$, because e is the only emf in the circuit tending to produce flow of current. The usual conception of a distinct flux due to the current i producing a certain flux linkage known as the self-inductance of the circuit is avoided; but its equivalent has not been overlooked, seeing that the magnetomotive force due to the current in the coil is a factor in the production of the flux actually linked with this current at the instant of time considered. It is not suggested that the orthodox method of introducing self-induction and mutual induction as separate entities endowed with certain properties peculiarly their own is not without advantages in the solution of many problems, especially when mathematical analysis is resorted to, but it tends to obscure the issue when seeking a clear understanding of the physical aspects of commutation. The splitting up of the magnetic induction resulting from different causes into several components is frequently convenient and should not be condemned except in certain cases when iron is present in the magnetic circuit. It cannot, however, be denied that self-induction and mutual induction are frequently thought of as different from other kinds of induction. Indebtedness for this state of things is due to some writers whose familiarity with mathematical methods renders a clear physical conception of complicated phenomena unnecessary, but the practical engineer or designer who produces the best work, especially in departures from standard practice, is usually he who has the clearest vision of the physical facts involved in the problem under consideration. If the term self-induction calls up a mental picture of magnetic lines, being a certain component—expressed in maxwells—of the total or resultant flux of induction in a circuit, this does not prevent speaking of flux linkage per ampere of current as inductance—expressed in henrys—and using the formula $e = L\frac{di}{dt}$ to calculate that component of the total emf in a circuit which would have a real existence if the field due to the current i in the wire were alone to be considered.

Following the lead of Mr. Lamme, the wires in the coil undergoing commutation will be thought of as cutting through a total flux of induction, expressed in magnetic lines or maxwells, this flux being the result of the magnetizing forces of field coils and armature windings combined.

In Fig. 1 the thick line rectangle represents a full-pitch armature coil of T turns undergoing commutation. The dotted rectangles show the position of two consecutive field poles, and the shaded curves represent the ascertained or calculated flux distribution over the armature surface. The ordinates of this curve indicate at any point on the periphery the density of the flux entering the armature core. The direction of slope of the shading lines indicates whether the flow of flux is positive or negative. There are means of determining, within a reasonable degree of accuracy, the air-gap and interpolar flux distribution for all conditions

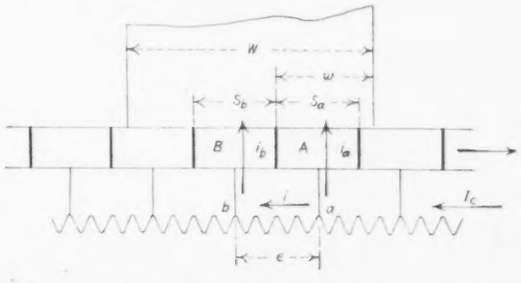


FIG. 3—CURRENTS IN COMMUTATED COILS AND CONNECTIONS

of field magnet strength, armature load, and brush lead,[5] and the assumption is here made that such curves can readily be drawn to represent the actual peripheral flux distribution in the commutating zone. The coil is supposed to be moving from left to right, and measure-

[4] Reply to discussion, *Trans.* A. I. E. E., Vol. XXX, p. 2426 (1911).

[5] See, for instance, W. E. Goldsborough in *Trans.* A. I. E. E., Vol. XVII, p. 679.

ments on the horizontal axis $X\ X$ may represent either distance traveled or lapse of time, since the armature is revolving at a uniform speed. The case considered is that of a dynamo without commutating poles, with brushes moved forward from the geometric neutral or no-load commutation position until a neutral commu-

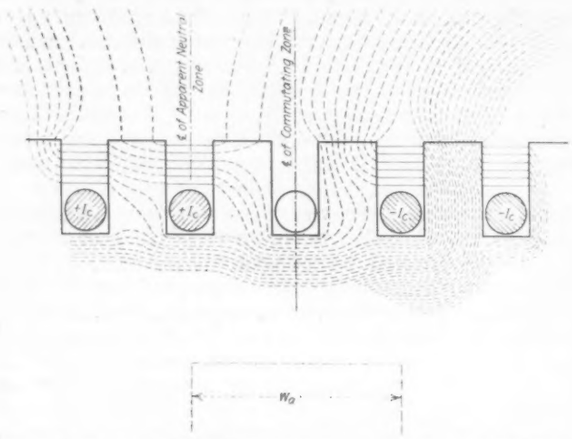


FIG. 4—FLUX DISTRIBUTION DUE TO MMF OF ARMATURE

tating zone is again found. The flux curves as drawn are the result of the combined mmfs of field coils and armature windings. During the time of commutation, t_c, which, if we neglect the effect of mica thickness, is the time taken by a point on the commutator to pass under the brush of width W, the conductors on the right-hand side of the short-circuited coil have been moved through the neutral zone from a weak field of positive polarity into a weak field of negative polarity, while the conductors on the left-hand side of the coil have moved from a weak field of negative polarity into a weak field of positive polarity. Owing to the symmetry of the fields under the poles of opposite polarity (i.e., the similarity in shape and equality in magnitude of the shaded flux curves), and the fact that the small portions of the flux curves near the neutral point may be considered as straight lines, the resultant flux cut by the two coil sides—joined in series by the end connections—may be represented by the shaded area in Fig. 2, where positive values are measured above, and negative values below, the horizontal axis. Intervals of time are measured horizontally from left to right, and the straight line $B\ B'$ represents the flux distribution in the commutating zone. The direction of this flux is such as to develop in the short-circuited coil, at every instant of time during the period of commutation, an emf tending to produce a current in the required direction; that is to say, from the commencement of short-circuit, when $t = 0$, until the middle of the commutation period, when both flux and current are of zero value, the small amount of flux cut by the short-circuited conductors is of the same kind as that previously cut by the conductors, while from the time $t = t_{c/2}$ until the end of commutation ($t = t_c/2$) the flux is of the opposite kind, being such as will cause the current to flow in the opposite direction. The amount of the flux required to bring about this condition is a small percentage of the flux cut by a coil under the main poles in the same interval of time, because the resistance of the armature windings is always low in comparison with the resistance of the external circuit, and, as a matter of fact, it is the *average* value of the flux entering the armature over the commutating zone with which the designer is usually concerned. If the brushes are so placed as to bring the short-circuited conductors in a neutral field, satisfactory commutation will result. At first sight it would seem that this general statement, being manifestly true, requires no further elucidation, but it has been known to have much the same effect as the proverbial red rag upon the normally inoffensive bull, as evidenced by the controversy which raged in the technical journals of not very distant date.[6] It is not the purpose of the present writer to take part in this controversy, because it seems to him that all, or nearly all, those who have written on this subject are agreed as to the desirable conditions for ideal commutation. Apart from the disinclination experienced by all but exceptional persons to admit the reasonableness of an opponent's point of view, the origin of controversies is usually a misunderstanding based on differences of language or the misuse of words. It is rarely that two men will regard a problem from exactly the same viewpoint, and, in the present writer's opinion, stereotyped methods of presenting the admittedly difficult problem of commutation are, therefore, to be avoided. The chief merit of Mr. Lamme's Institution paper, previously referred to, lies in the fact that it departs from conventional methods.

Returning to a consideration of the case represented by Fig. 1, it must not be overlooked that the armature coil there shown is not of a practical shape, the end connections are shown parallel to the direction of travel of the coil, and the cutting of fluxes by these end portions of the coil has not been considered. When we consider the end fluxes, or the effect of commutating interpoles, especially when these are not equal in number to the main poles or do not extend the full length of the armature core, then the flux cut by the short-circuited conductors at any given part of their total length—such as the center of the "active" portion, whether on a smooth core or in slots—may have an appreciable value; but if we consider the *total* flux cut by *all* parts of the wire forming the commutated coil, at the instant of time when the current i in this coil is of zero value, it is most emphatically true that the coil as a whole is moving in a "neutral field," i.e., a resultant field which is either of zero value (when the sum of all its components is correctly taken) or of which the direction is parallel to the direction of travel of the conductors.

At the beginning and end of the commutation period the field in which the coil moves should be such as to produce an emf in the short-circuited coil of the value

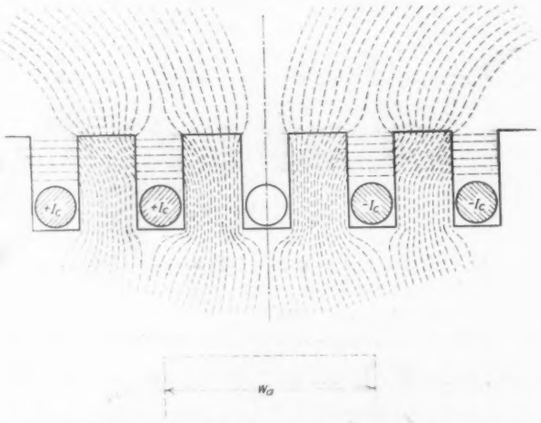


FIG. 5—FLUX DISTRIBUTION IN COMMUTATION ZONE

$e = I_c r$, where I_c is the value of the current per path of the armature circuit and r is the resistance of the short-circuited coil. On the assumption of a uniform current density over the surface of the brush, the brush

[6] Refer C. L. R. E. Menges in the London *Electrician*, Feb. 28 and April 11, 1913.

contact resistance need not be taken into account, as will be clear from the following considerations. Fig. 3 shows a brush of width W covering several segments of the commutator. The total current entering the brush is $2I_c$, and since the density is constant over the surface of contact, the current entering the brush through any surface of width S is $2I_c \times \frac{S}{W}$. To calculate the volts e that must be developed in the coil of resistance r when the distance yet to be traveled before the end of commutation is w, consider the sum of the potential differences in the local circuit $AabB$ which is closed through the material of the brush. This leads to the equation

$$e = ir + i_b r_b - i_a r_a \qquad (1)$$

where r_a and r_b are contact resistances depending upon the areas of the surfaces through which the current enters the brush. Under the conditions shown in Fig. 3, the contact surfaces S_a and S_b are equal, and the currents i_a and i_b are therefore also equal. It follows that the voltage drops $i_a r_a$ and $i_b r_b$ are equal and cancel out from equation (1). The same is true in the later stages of commutation when S_a is no longer equal to S_b but to the portion w of the brush which remains in contact with the segment A. The relations between the currents and the surface resistances are then obtained by expressing these quantities in terms of the contact surface, thus:

$$i_a = w \times k_1$$
$$i_b = S_b \times k_1$$
$$r_a = \frac{1}{w} \times k_2$$
$$r_b = \frac{1}{S_b} \times k_2$$

where k_1 and k_2 are constants, and the voltage drop $i_a r_a$ is seen to be still equal to the drop $i_b r_b$. It follows that the only emf to be developed in the short-circuited coil when uniform current distribution is required will be $e = ir$.

The instantaneous value (i) of the current in the coil undergoing commutation can be expressed in terms of the brush width W and the distance (w) through which the coil still has to travel before completion of commutation, because,

$$i = I_c - 2I_c \times \frac{w}{W}$$
$$= I_c\left(\frac{W - 2w}{W}\right)$$

and

$$e = I_c r\left(\frac{W - 2w}{W}\right) \qquad (2)$$

At the beginning and end of commutation, when w is equal to W or to zero, the maximum value of the required voltage is $e = I_c r$.

In this study of the voltage to be developed in the coil undergoing commutation in order to produce a uniform current distribution over the brush surface, the resistance of the brush itself has been considered negligible; but with the assumption of a uniform current distribution over the cross-section of the brush the actual resistance of the brush material, even if it is relatively high, will not appear as a modifying factor in the general formula (2).

Referring again to Fig. 2, if the flux curve $B\,B'$ may be considered a straight line, the current $\left(i = \frac{e}{r}\right)$ will also obey a straight line law. It will fall from the value $+ I_c$ to zero in the time $\frac{t_c}{2}$ and rise again to the value $- I_c$ at the end of the period t_c according to the simple law expressed by the straight line in Fig. 2. If the change of current actually occurs in this manner, we have what is called "straight line" or ideal commutation. The commutation is then ideal or perfect, not only because it relieves the designer of much intricate and discouraging mathematical work, but because it is the only means by which the current density can be maintained constant over the brush surface of the usual rectangular form. It is generally the aim of the designer to maintain this current density as nearly constant as possible, because unequal current density leads to local variations of temperature and resistance in the carbon brush, and in those parts where the density attains very high values the excessive heating leads to pitting of the commutator surface even if visible sparking does not occur. Whatever method of studying commutation phenomena is followed, it is usual to assume some law connecting the variable current i with the time t and then investigate the causes which will bring about this condition. The straight line law will therefore be assumed, but the thing of immediate moment—being in fact the whole problem of commutation in its broader aspect—is the location,

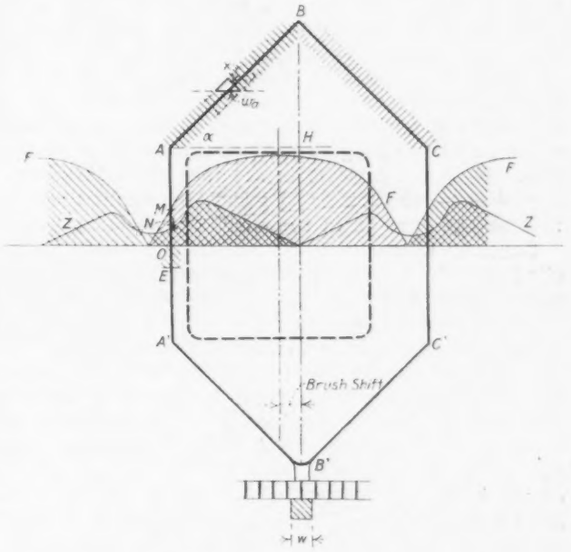


FIG. 6—CORRECTION FOR CUTTING OF END FLUX

or the creation, of a neutral zone where the actual resultant flux cut by the coil undergoing commutation will be zero.

Although the assumption of a smooth core armature very greatly simplifies the problem, especially when an effort is made, as in this paper, to picture the actual distribution of the magnetic flux, it seems preferable to consider a machine with toothed armature because this is the case which has generally to be dealt with by the practical designer, and moreover it is exactly this question of teeth, or what is known as the slot flux, which was one of the bones of contention in the recent "neutral zone" controversy. This suggests that the presence of the teeth introduces a factor which may not be disregarded in any modern theory of commutation.

In Fig. 4 an attempt has been made to represent, by the usual convention of magnetic lines, the flux due to the armature current alone, which enters or leaves the armature periphery in the interpolar space when the field magnets are unexcited. The position chosen for the brushes is the geometric neutral—i. e., the point midway between two (symmetrical) poles—and the

magnetic lines leaving the teeth will cross the air spaces between armature surface and field poles and so close the magnetic circuit. The brush is supposed to cover an angle equal to twice the slot pitch; the current in the conductor just entering the left-hand end of the brush is $+I_c$, the current in the conductor under the center of brush is zero, and the current in the conductor just leaving the brush on the right-hand side is $-I_c$. The armature is supposed to be rotating, and it will be seen that the conductors in which the current is being commutated are cutting the flux set up by the armature as a whole. It is important to note that the flux cut by a conductor while traveling between the two extreme positions during which the short-circuit obtains is not only the flux passing into the air-gaps from the tops of the teeth included between these extreme positions of the conductor but includes also the flux due to the currents in the short-circuited conductors, which crosses the slot above the conductor[7] and leaves the armature surface by teeth which are not included in what at first sight may seem to be the commutating zone. In other words, the portion of the armature flux cut by a conductor undergoing commutation is that which passes up through the roots of the teeth included between the two extreme positions of the short-circuited coil. This picture of the conductor cutting the field set up by the armature currents is especially useful when calculations are made, as will frequently be found convenient, by considering the separate component fluxes due to distinct causes, all combining to produce the actual or resultant flux. It is not difficult to see that the flux shown in Fig. 4 is never such as to generate an emf tending to reverse the current in the short-circuited conductor.

Consider now Fig 5. The main poles have been excited and the brushes moved forward until a satisfactory commutating zone has been found where the fringe of flux from the leading pole tip is sufficient to neutralize the flux due to the armature windings.[8] With the main-pole excitation tending to send flux through the armature core from right to left, and the armature emf tending to produce a flux distribution generally as indicated in Fig 4, the resulting flux distribution in the commutating zone will be somewhat as shown in Fig. 5. Here the flux cut by the conductors during commutation is represented by eight lines only. the direction of this commutating flux being such as to maintain the current during the earlier stages of commutation and reverse it during the later stages. At a point midway between the two extreme positions the conductor is cutting no flux, and the current is therefore zero. It should be observed that the correct position for the brush is in advance of the "apparent" neutral zone; that is to say, the position of the neutral field on the surface of the armature does not correspond with the correct position for the center of the brush. That is because the slot flux must enter through the upper part of the teeth if it is not to be cut by the conductors during commutation. Thus the conductor, which at the instant of time $t = \frac{t_c}{2}$ must be in a neutral field, is actually below a point on the armature periphery where flux is entering or leaving the teeth, and this condition occurs even when, as in the present instance, the effect of the end connections is entirely negligible. This flux, which enters the teeth comprised between the two extreme positions of the commutated conductors, is neither more nor less than the slot flux (or equivalent slot flux, as the case may be). It is represented by twelve lines in the diagram Fig. 5, and it must be provided by the leading pole shoe if brush shift is resorted to, or by the commutating interpole when this method of canceling the armature flux is adopted. When the effect of the end connections of the armature coils cannot be neglected, the armature flux cut by this portion of the short-circuited coil must be canceled in the same way as the slot flux; that is to say, an equal amount of flux, but of opposite sign, must enter the armature from the leading pole tip or interpole, and this component of the compensating flux will actually be cut by the conductors in the slot, thus neutralizing the emf developed by the cutting of the end fluxes. This will be made clearer by reference to Fig. 6, which is generally similar to Fig. 1, except that, instead of the actual interpolar flux, two distinct curves have been drawn, the one, F, representing flux distribution over armature periphery due to the field coils acting alone, and the other, Z, representing the flux distribution due to the armature windings acting alone. The addition of these two fluxes at every point will not always reproduce the actual flux curve of Fig. 1, because of possible saturation of portions of the iron circuit such as the armature teeth and pole tips; but, in the commutating zone, the method of adding the several imaginary components of the actual flux is not objectionable, and the active conductor $A\ A'$ in Fig. 6 may be considered as moving in a field of which the density is represented by the length $M\ N$, since the portion of the field flux represented by the distance between the point N and the datum line is neutralized by the armature flux at this point. Let $A\ B\ C$ represent the position of the end connections of the coil undergoing commutation, then the portion $A\ B$ is cutting end flux due to the armature currents in all the end connections, and the direction of this flux will be the same as that represented by the curve Z, all as indicated by the direction of the shading lines. The portion BC of the short-circuited coil will be cutting flux of the same nature as that cut by the slot conductors CC', and the emf due to the cutting of the end fluxes will be of the same sign as that due to the cutting of the armature flux Z; that is to say, it will tend to oppose the reversal of current and must therefore be compensated for by a greater brush lead or a stronger commutating pole. Similar arguments apply to the end connections $A'B'C'$ at the other end of the armature. A means of calculating the probable value of the effective end flux will be considered later; but for the present it may be assumed that the average value of the density B_e of the field cut by the end connections is known. It may therefore be used for correcting the ordinate of the curve Z at the point O. Thus, the flux cut by the portion ABC of the end connections (see Fig. 6) in the time t_c is

$$\Phi_e = B_e \times x \times \text{length of } ABC$$

or

$$\Phi_e = B_e w_a \sin \alpha \times \text{length of } ABC$$

where α is the angle between the lay of the end connections and the direction of travel, and w_a is the arc covered by the brush, expressed in centimeters of armature periphery. The equivalent flux density B_a which has to be cut by the slot conductors AA' to develop the same average voltage is obtained from the relation

$$B_a w_a \times \text{length } AA' = B_e w_a \sin \alpha \times \text{length } ABC$$

which gives

$$B_a = B_e \sin \alpha \times \frac{\text{length } ABC}{\text{length } AA'} \qquad (3)$$

or, if preferred,

[7] For the sake of simplicity, a single conductor is shown at the bottom of each slot and the whole of the slot flux is supposed to link with it. The calculation of the "equivalent" slot flux will be taken up later.

[8] Credit is given the reader for the ability to read in the expression "a flux neutralizing a flux" the more scientific but less convenient expression "the magnetic force due to one magnetizing source being of such magnitude and direction as to neutralize the magnetic force due to a second magnetizing source, thus causing the resultant flux of induction to be of zero value."

$$B_a = B_e \frac{2\,(BH)}{(AA')}$$

This may be plotted in Fig. 6 as the ordinate *OE*, making *NE* represent the armature flux, on the assumption that the whole of this flux component is cut by the "active" portion of the coil; and this suggests a graphical method of locating the correct brush position when commutating poles are not used, because what may be called the equivalent neutral zone is found when the conductor *AA'* occupies a position such that the length *NE* is exactly equal to *OM*. If this position cannot be found without passing under the tip of the pole shoe (represented by the heavy dotted rectangle), the machine will not commutate perfectly without the addition of a commutating interpole.

The question of relative magnitude of these end flux emfs deserves some attention, because it would be foolish to complicate the problem of commutation if the correction, when made, is of little practical moment. It is claimed by some writers that refinement of analysis and calculation is always commendable even when built upon a foundation that is admittedly a mere approximation. With this attitude of mind the present writer has no sympathy; it appears to lack the sense of proportion. Apart from any considerations of a mechanical nature, the practical problem of commutation, from whatever point of view it is approached, is, and always will be, the correct determination of the field in which the short-circuited coil is moving, whether this conception of the magnetic condition is buried in the symbols *L* and *M*, and referred to as inductance, expressed in henrys, or considered merely as any other magnetic field; and it would surely be a waste of time and mental effort to introduce refinements if the percentage correction, when made, is of a small order of magnitude. The question of end fluxes, however, is one of real practical importance; the end flux in actual machines is not of negligible amount, and although it cannot be calculated exactly, it is a factor which should not be left out of consideration. It is true that we do not concern ourselves with the end fluxes when calculating the useful voltage developed in the active coils; but, apart from the fact that in this connection the amount of the end flux is relatively small, it is not difficult to see that the emfs generated in the end connections as they cut through the end fluxes due to the armature currents balance or counteract each other and have no effect on the terminal voltage. The conception of the end connections cutting through the flux due to the armature as a whole, as indicated in Fig. 6, seems more natural, and is more helpful to the understanding of commutation phenomena, than what might be termed the academic method, in which more or less reasonable assumptions are made in respect to self and mutual inductances; but it is not suggested that the one method is necessarily superior to the other so far as practical results are concerned.[9] While moving from the position at the commencement of the commutation where the current is $+I_c$ to the position at the end of commutation where the current is $-I_c$, the short-circuited coil has cut through the flux of self and mutual induction—through the whole of it, not merely through certain components of the total flux in the particular region considered. This is well expressed by Mr. Menges when he says[10]: ". . . Self-induction is in no way distinguishable from other co-existent electromagnetic induction. Therefore, when the real magnetic flux resulting from all causes, and its changes relative to a given circuit, are taken into account, the self-induction is already included, and it would be erroneous to add an emf of self-induction."

[9] As a matter of fact, a careful study of the problem will show that the total armature flux cut by one commutating coil during the period of short-circuit—being the difference between the number of lines threading the coil immediately before and immediately after commutation—is practically entirely due to the changes of current that have taken place in the coils under the brushes during the period of commutation.

[10] C. L. R. E. Menges in the London *Electrician*, Feb. 28, 1913.

Motor-Driven Prayer Wheels

According to the *Wide World*, the Buddhists in the far-distant Himalayas are utilizing electricity to drive their prayer wheels, which have heretofore been turned by hand, wind or water-power. This unique application of electricity has been brought about to conserve the flow of mountain streams which are being developed to furnish hydroelectric energy for lamp and motor service in Simla, the summer capital of India. Many of the small streams which formerly drove prayer wheels will now be robbed of their water during the dry seasons to increase the flow of the larger streams furnishing power to hydroelectric equipment. To avoid interfering with the long-established religious practices of the Buddhists, the government of India has therefore required the power company to equip with motors the prayer wheels affected and to furnish energy during the dry seasons without charge. The prayers (sometimes as many as several thousand) are usually inscribed on the shafts of the prayer wheels, one revolution of the wheel being considered equivalent to repeating verbally the same prayer.

Rutherford on the Atom

In a lecture before the National Academy of Sciences at Washington, D. C., recently Sir Ernest Rutherford discussed the structure of the atom and the bearing of recent researches on this subject. The speaker outlined a theory of nuclear atoms according to which a central nucleus of extremely high potential is surrounded by negative electrons whose motion it controls. The electrons are controlled by the nucleus very much as the planets are held to the solar system by gravitation, and, indeed, there appears strong reason to suppose that the force involved is really inversely proportional to the square of the distance as in the case of gravitation. From this point of view, the various elements are characterized by the number of electrons in the atom. Each electron carries a single negative charge, and the nucleus carries as many positive charges as there are electrons to be controlled. This theory of the atomic constitution explains the irregularity in the movement of alpha particles through a gas. When an alpha particle approaches a nucleus carrying a charge of millions of volts it is sharply deflected and may appear even to rebound in the direction from which it came.

It is possible to determine the number of positive charges contained in each one of the elements from hydrogen to uranium, and it seems also that if the elements are appropriately arranged the charges increase by unit steps, so that hydrogen contains a single positive charge and uranium ninety-two. This assumption corresponds to the actual elements with a small but very important exception. In the series of ninety-two possible charges there are just three gaps, corresponding, presumably, to three unknown elements. The relationship of these unknown elements to the known elements is made clear, so that the chemists have preliminary information to guide them in the search for the missing links. This is a wonderful advance on the periodic system, which has itself been fruitful in the discovery of elements.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods and Current Practice Among Successful Utilities

Results of Electric-Iron Sales at Muncie, Ind.

During a recent electric-iron sale the Muncie Electric Light Company offered a 6-lb. standard General Electric iron for $1.98 to anyone who brought in an old iron of any type. Although the majority of irons were of the exterior-heated style, it is of interest to note that some customers returned old electric irons worn out in service. In the month during which this sale continued the company disposed of 175 irons.

Since discontinuing this campaign the company has been offering solicitors a commission of 25 cents per iron for selling the irons at $2.25 each. Although this offer seems attractive at first glance, the solicitors have reported that from 80 per cent to 90 per cent of the company's customers are already users of electric irons.

One Way of Encouraging Evening Reading

As the spring season advances and the hours of electric lighting grow shorter, the Fort Worth (Tex.) Power & Light Company is encouraging reading in the home. To this end, there appears on one side of its monthly statement post cards the reminder shown

All the privileges of the City Public Library are Free; there are over 22,000 books at your command. Have you and the members of your family registered? If not, then do so at once.

FORT WORTH POWER AND LIGHT COMPANY

THE CENTRAL STATION AND THE PUBLIC LIBRARY

herewith, pointing out the educational opportunities afforded by the Fort Worth city library and urging readers not only to register at the library themselves but to arrange so that all members of the family may draw books.

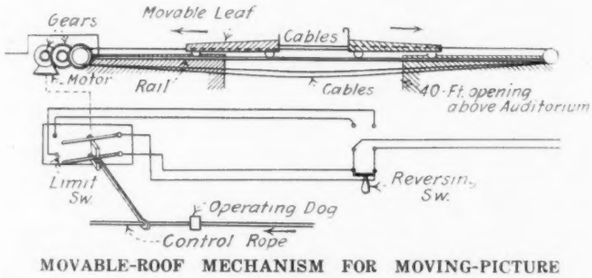
An Insect's Effect on Central-Station Revenue

As the results solely of the ravages of a tiny insect in its vicinity, one Southern central station has this year suffered a reduction of more than 20 per cent in its gross income. Fifteen months ago the boll weevil made its appearance in this district, and since that time cotton, the principal local crop, has been a failure. That the influence is only local is proved by the fact that the country's crop of cotton last year was a banner one.

The depression in income of the plant referred to, it is interesting to note, has not been confined strictly to receipts from its customers who depend directly upon the cotton industry. The plague of the boll weevil has made itself felt throughout every department of the company's business, even affecting the average lighting bills of the community. The most direct loss was, of course, caused by the shutting down of several cotton gins which formerly paid the central station $500 to $1,000 per month during the ginning season.

A Moving-Picture Theater with a Movable Roof

By means of motor-operated roof leaves, the Princess Theater, Meridian, Miss., can be quickly converted into an open-air auditorium, or at the approach of a sudden shower the covering can be almost instantly rolled back into place while the performance goes on uninterrupted. The 20-ft. by 40-ft. opening in the roof is arranged with movable leaves which travel on small rails and are operated by cables passing over a double drum gear-driven by a 3-hp motor. The two closed cable loops are wrapped on the drum in opposite directions and each operates one leaf. The control rope, which moves simultaneously with the main leaves, has dogs mounted at the limits of its travel. These dogs operate a reversing switch which stops the motor and connects it ready for starting in the opposite direction. About one minute is required to open or close the roof, moving both leaves through their entire travel. The



MOVABLE-ROOF MECHANISM FOR MOVING-PICTURE THEATER

construction of the joints about the opening is such that the roof is thoroughly weatherproof. Motor, gears and switches are housed in roof boxes. The proprietor of the show-house is well pleased with the innovation, which affords him all the advantages of an outdoor open-air theater with full protection during inclement weather.

Electrical Presents for June Brides

Under the caption "The Open Season for Brides" the Glenwood Light & Water Company, of Glenwood Springs, Col., has mailed to its customers a timely announcement card which reads as follows:

"June is one of the best months in which to get married. The other good months are October, February, April, September, January, November, May, August, March, July and December. This brings up the question of wedding presents, and we rise to remark that there is nothing so acceptable to the bride as an electric coffee-pot, iron or other electric appliance. We have a considerable variety in stock at all times.

"Sometimes a bride gets duplicate presents. If any

Glenwood bride gets duplicate electric gifts purchased from us, we are always ready to exchange them for other appliances.

"Here's congratulations to the marital partnerships floated in Glenwood Springs this sunny June month!"

A Flat-Rate Schedule with an Active-Room Element

To discourage present metered customers from changing over to its controlled flat-rate schedule, the Jackson (Miss.) Light & Traction Company includes in the terms of the latter rate a minimum based on the number of "active rooms" in the house. Bathrooms, halls and galleries or porches are not counted, but for all other rooms the customer must contract for a minimum of at least 25 watts per room. Thus a four-room cottage has a minimum connected load of 100 watts, a six-room dwelling 150 watts, and so on. The rate is 1 cent per watt of connected demand per month, the customer buying his own lamps. About 200 flat-rate customers are now served from the lines of the Jackson company, and of this number about twenty-five changed over from metered service. It is thought that comparatively few will in future care to make the change.

Cotton-Carrying Electric Trucks on the Galveston Piers

For transporting bales of cotton between the Moody compress and the steamship piers at Galveston, Tex., distances varying from 0.5 mile to 4 miles, use is made of three special 6-ton electric trucks, equipped with "pack saddles" as shown in the accompanying illustration, which enable one truck to carry about thirty compressed bales of cotton. Although the trucks are rated at only 6 tons, they are commonly used to transport loads as high as 18,000 lb. In this way, at the present time, about 200 bales, varying from 550 lb. to 600 lb. in weight, are being transported daily between the cotton compress and the docks. The trucks are owned by the Galveston Motor Company, which now has three in service and will shortly add seven more similar vehicles to its cotton-carrying fleet.

FIG. 1—COTTON AWAITING TRANSPORTATION

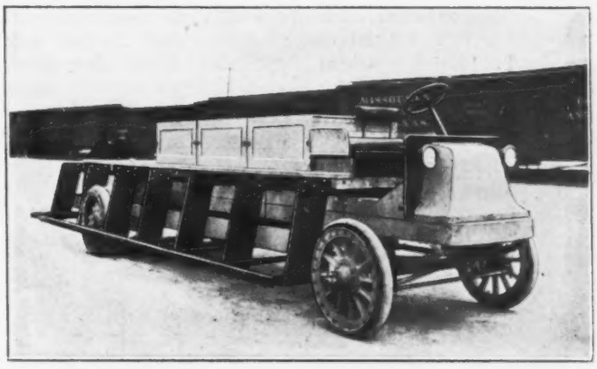


FIG. 2—ELECTRIC TRUCK FOR TRANSPORTING COTTON

The trucks are of the General Motors Company type, fitted with forty-four cells of twenty-one-plate "Ironclad" battery, and are equipped with the special "pack saddles" which were designed by Mr. John Mitchell, general superintendent of the Moody compress. Mr. Mitchell has applied for a patent on his device. Energy to operate the trucks is furnished by the Brush Electric Company, Galveston, Tex., of which Mr. Fred M. Lege, Jr., is general manager.

Co-operative Publicity Scheme in Conducting Electric House

Model "electric houses" maintained by central-station companies are no longer a novelty, but the one conducted by the Rockford (Ill.) Electric Company for five spring days is interesting because of the co-operative method of supporting it. Publicity, of course, has to be governed by the expense, so Mr. A. C. Martin, sales manager of the company, evolved the idea of interesting a real-estate firm and some household furnishers in the scheme of conducting an electric house and induced them to share in the expense of maintaining it.

Primarily it was necessary to awaken interest in the project even before the merchants were approached, and this was done by inserting a news story in one of the daily papers. In this way the interest of the mer-

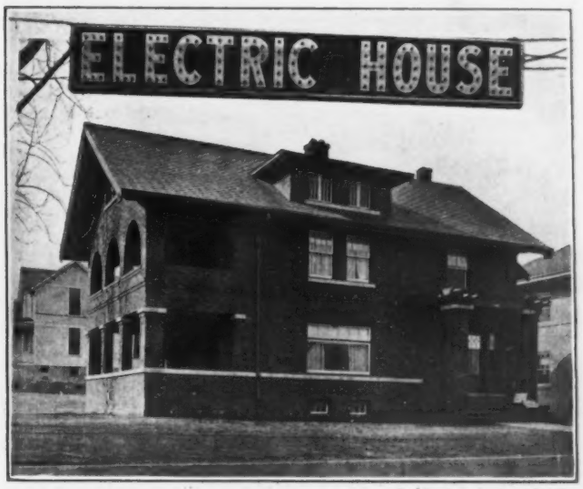


FIG. 1—"THE HOUSE ELECTRIC," ROCKFORD, ILL.

chants was aroused and the rest was easy. A local real-estate firm loaned one of its newest houses in a residential district, while furniture, rugs, draperies, art decoration, linen, china and kitchen utensils were furnished by other dealers in the city. The electric-service company, assisted by electrical manufacturers and contractors, equipped the house electrically.

FIG. 2—THE DINING-ROOM

One energetic advertising manager of an afternoon newspaper, who conceived the idea of publishing an electrical page every day during the exhibit, secured advertisements from every merchant exhibiting in the "electric house." The center column of this page was devoted by the newspaper company, without charge, to articles relating to the house. Other local newspapers followed the example and gave the project considerable publicity. During the first ten days of the exhibit fifteen full-page advertisements were run concerning the "electric house," one-fifth of the expense being borne by the central-station company.

The house was opened on a Saturday, and people arrived in crowds. Transportation to and from the house was furnished by the local railway company, which also displayed advertising cards on the front of its cars.

FIG. 3—COSY CORNER OF THE LIVING-ROOM

During the first week more than 9000 persons visited the house. Oftentimes, especially during the evening, the crowds were so large that it was impossible to accommodate them all at one time. Two representatives of the company, one of each sex, were stationed in the reception hall to receive guests on behalf of the electric-service company. Each guest was requested to register. Other representatives of the company were in attendance in other parts of house to answer questions and explain details. An electric piano and a victrola furnished the latest popular airs and grand-opera productions.

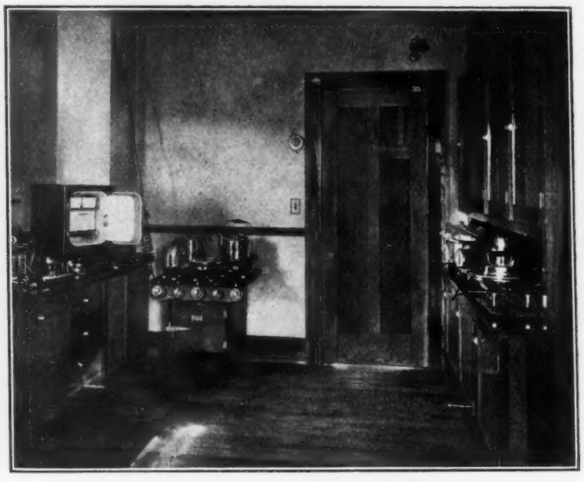


FIG. 4—THE "ELECTRIC KITCHEN"

All rooms were equipped with the latest electrical devices making for home comfort. The kitchen contained an electric range and oven, electric grills, percolators, etc. The laundry was equipped with various laundry appliances, including a large stationary vacuum cleaner. The bedrooms were fitted with bed lamps, telephones, fans and electric heating pads. Displayed conspicuously in the bathroom were vibrators, hair-driers, bottle warmers, etc. Every room was artistically and effectively illuminated. Luminous heaters were installed in the fireplace in the living room.

In planning the "house electric" the company intended to keep it open for one week, but the number of visitors did not diminish during that time, so the exhibit was prolonged over two weeks. During the second week special sales were conducted. The real-estate company sold its house; the house furnishers closed several contracts, and the electric-service company sold twenty-five toasters and 140 flatirons, besides securing a number of "prospects" for other energy-consuming devices.

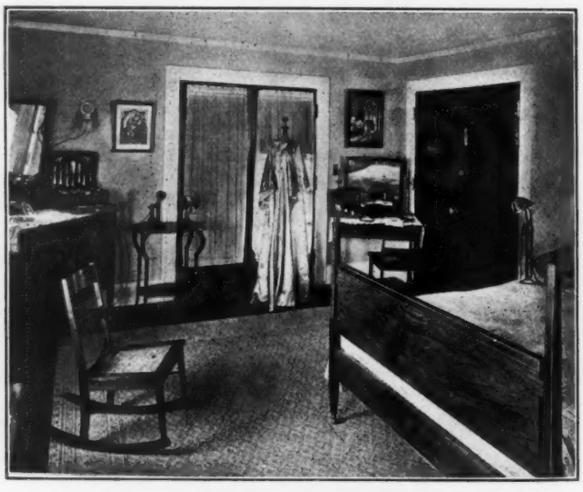
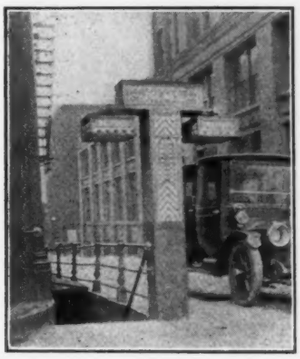


FIG. 5—THE CIRCASSIAN-WALNUT BEDROOM

Illumination and Wiring

An Illuminated Barber Post

A barber-shop advertisement which is somewhat out of the ordinary has been erected in front of the Neil Hotel, Columbus, Ohio. As shown herewith, the post



ILLUMINATED ART-GLASS BARBER POLE

consists of a square vertical column surmounted by a cross-bar bearing two ornamental suspended lamp inclosures. The entire upper part of the post is made up of colored glass illuminated from within by tungsten lamps. Two lamps are mounted in the body of the post, while a single lamp furnishes illumination for each division at the top.

Electric Lighting of a Church Bulletin

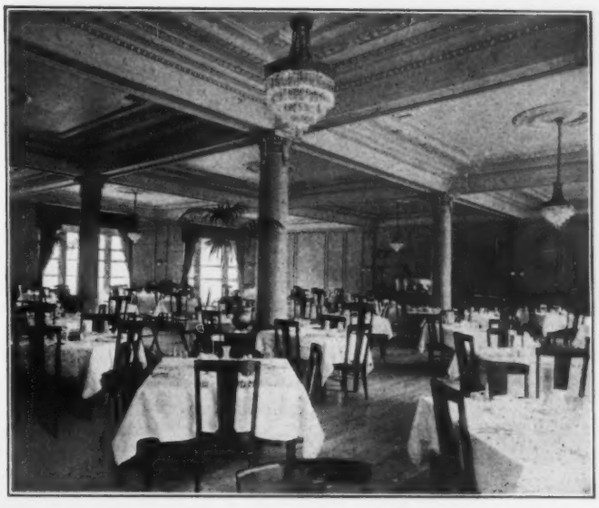
A simple but well-designed bulletin of services is in use by the First Baptist Church, Hartford, Conn., as illustrated herewith. The display board is 6 ft. high and 3 ft. wide and is lighted by a 60-watt lamp housed

ILLUMINATED CHURCH BULLETIN

in a parabolic reflector hung about 12 in. away from the reading surface. The lamp is placed so that the greater part of its light is thrown upon the sermon subject, which is displayed about 6 ft. above the sidewalk close to the church entrance.

Hotel Vermont Dining-Room Lighting

One of the most effectively lighted dining-rooms in New England hostelry service is that of the Hotel Vermont, Burlington, Vt., which was the headquarters of the last convention of the New England Section of the N. E. L. A. The service is furnished by the Burlington Light & Power Company, and the room, which is about 60 ft. square, is composed of nine bays 19.5 ft. square, and is finished in cream with mahogany tables and chairs. The ceiling height is about 13.5 ft. Each bay is equipped with a central outlet from which depends a chandelier about 6 ft. long provided with six outlets, only four of which are used, 15-watt lamps being employed. The reflectors consist of four circular sets of glass prisms about 12 in. high over all and 18 in. in maximum diameter. Exclusive of the wall lighting, which is done by twelve sets of brackets carrying two 15-watt lamps each in prismatic reflectors harmonizing with the pendent fixtures, there is an expenditure of only 540 watts for a floor area of 3600 sq. ft. The wall bracket fixtures each consist of sixteen glass prisms 6 in. long with ½-in. sides, hung in a circle of 3-in. diameter 6 ft. above the floor, the pairs of prism groups in



WELL-LIGHTED HOTEL DINING-ROOM AT BURLINGTON, VT.

each bracket being 11 in. apart on centers. The wall units aggregate 360 watts, making a total expenditure of 900 watts for the room, or 1 watt for 4 sq. ft. of floor area. The illumination is ample for reading the smallest type used on menu cards.

Latest Developments in Gas-Filled Tungsten Lamps

A meeting of the Pittsburgh Section of the Illuminating Engineering Society, which embraces Cleveland, was held at Nela Park, East Cleveland, on a recent evening. About twenty members from Pittsburgh attended the Cleveland meeting. With some other out-of-town guests they were entertained at dinner by the National Lamp Works of the General Electric Company. The gentlemen present inspected the lamp laboratories at Nela Park, the meeting being held in one of the buildings. Mr. S. E. Doane, chief engineer of the works, opened the evening's program by explaining how Nela Park had been located on suburban heights in compliance with a desire to get healthful and pleasant surroundings. Prof. H. S. Hower, of Pittsburgh, presided at the meeting. Mr. C. L. Dows,

of the lamp laboratories, gave an illustrated address on the latest developments in tungsten lamps. His talk related to the recent gas-filled lamp. He pointed out that the true standard of lamp efficiency is the number of lumens per watt. In the case of the gas-filled lamp this number is twenty-one or twenty-two. Owing to convection, the heat loss in the gas-filled lamp is greater than with the vacuum lamp. Heat loss with small filaments is relatively larger than with larger filaments. Experiments were shown to demonstrate this. But the filament in the gas-filled lamp can be operated at a higher temperature—that is, nearer the melting point—than in a vacuum lamp. This accounts for the higher efficiency.

Mr. Dows explained the practical advantages of coiling the filament in the form of a helix. Interesting pictures were thrown on the screen to show the filaments, greatly enlarged, first dark and then brought to red heat and white incandescence by the passage of a current of electricity. The speaker said that the currents most commonly used in the new lamps range from 5 amp to 20 amp. The 750-watt lamp is the lowest-wattage multiple gas-lamp now available. Experiments are in progress to adapt this lamp for use with motion pictures. For use with stereopticons it is now employed satisfactorily.

Lighting of Building Exteriors

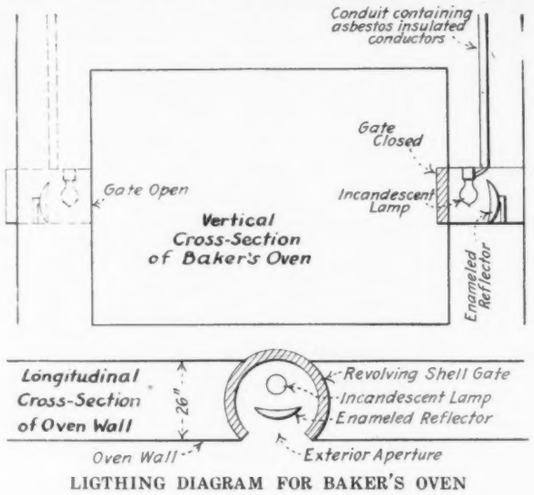
Mr. Ward Harrison, of the National Lamp Works, gave a talk on "The Lighting of Building Exteriors." This lighting is accomplished by the use of the new gas-filled lamp, with specially designed reflectors, which Mr. Harrison described. Previous to his talk, however, he gave a demonstration of portrait photography, using the gas-filled lamps to supply the light. The light reached the sitter through a diffusing screen made of tracing cloth. A screen on the other side of the sitter softened the shadow on the side of the face opposite to the diffusing screen. The exposure was of three seconds' duration and a satisfactory negative was made.

Mr. Harrison described the type of reflector used for the flood lighting of building exteriors. This reflector is designed so that a solid beam of light is projected. It is believed that many building fronts can be illuminated in this way. The lamps and reflectors are placed at some distance from the façade. In this manner the architectural beauties can be brought out at night. Furthermore, this flood lighting of building exteriors will place at the disposal of commercial houses a very dignified means of publicity or advertising. Mr. Harrison also described the new two-piece refractor for high-efficiency incandescent lamps. The refractor is of glass, the prisms being on the inside when the two pieces are put together, so that both the exterior and the interior of the completed refractor present smooth surfaces.

Messrs. G. H. Stickney, of Harrison, N. J.; Thomas F. Kelly, of Dayton, Ohio; M. Luckiesh, of Cleveland; M. E. Turpin, of Pittsburgh, and others took part in the discussion. Mr. Luckiesh said that the half-watt lamp gives light possessing greater actinic value than the light of the older tungsten lamps. He told about using colored screens to reduce the luminosity of light from high-efficiency gas-filled lamps without affecting its photographic value. He also spoke of using true-tint glassware with the high-efficiency lamps to give the equivalent of daylight. A Pittsburgh delegate described the spectacular method of illuminating, with colored screens, steam escaping from a stack, giving an excellent imitation of blast-furnace glare. In conclusion, Mr. Dows said that it was hoped to concentrate 1000 watts in gas-filled lamps to a greater degree than is done in the present 750-watt lamp.

Illumination of Interior of Baker's Oven

Incandescent lamps are being employed by a baking company in Vinita, Okla., to illuminate the interior of the ovens when it is desired to observe the progress of a "bake." Each lamp is supported in a cylindrical-



LIGTHING DIAGRAM FOR BAKER'S OVEN

shaped recess in the oven wall, the axis of the bulb and recess being vertical. Diagonally opposite apertures connect the recess with the interior and exterior of the oven. As a temperature of about 500 deg. Fahr. is maintained for baking and as the light is desired only for short intervals, a revolving cylindrical-shell cast-iron gate is provided to cover the interior aperture except when light is desired. An enameled reflector placed back of the bulb spreads the light over the interior of the oven when the aperture is opened by revolving the gate.

To give a neat outward appearance to the installation the electric-service wires are run to the lamp through conduit concealed in the oven wall. Although the wall is 26 in. thick, it was considered advisable, because of the existence of the very high temperature, to insulate the wires with slow-burning asbestos insulation. The Vinita Electric Light, Ice & Power Company furnishes electricity to this bakery.

A Map and Card System of Installation Records

The system of installation records employed by the Southwestern Gas & Electric Company, Shreveport, La., is one that has proved very useful for this community of 30,000 population. The key to the scheme is

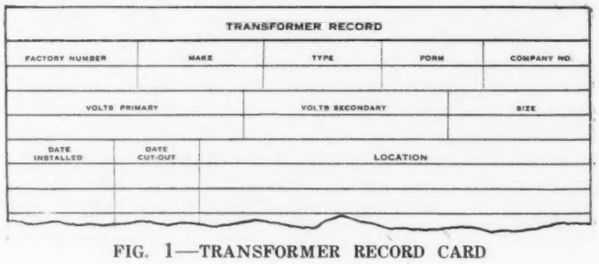


FIG. 1—TRANSFORMER RECORD CARD

a large blue-print wall-map of the city, in which tacks have been placed representing all the distribution transformers in service. Each tack is numbered to correspond with its transformer, those marked with red indicating three-phase units and those with black single-phase installations. In a standard filing cabinet

are filed numbered cards corresponding to each transformer in use, and behind each such transformer card there are inserted the installation record cards of all customers who receive service from that transformer. Where two or more transformers are banked, their record cards are pinned together with clips, and di-

INSTALLATION RECORD

NAME

ADDRESS

METER NO.	SIZE	VOLTS	R.	TRANS. NO.	DATE

WATTS	10	25	40	60	8C	100	160	250	500	TOTAL 16 C. P. EQUIV.

MOTORS	IRONS	FANS-BUZZ	FANS-CEILING	

DATES

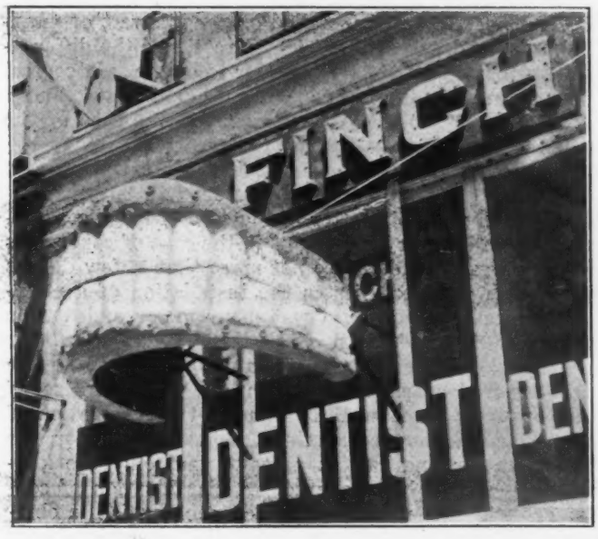
ON OFF

FIG. 2—CUSTOMER'S INSTALLATION RECORD CARD

rectly behind these cards, in the way already described, are filed the customers' installation records. At a glance, by this method, the line superintendent can determine the characteristics of any transformer on the system as well as the character of the customers' loads it supplies.

Electrical Dental Sign

Realizing the effectiveness of advertising a business through the medium of an electric sign, a dentist on Forty-second Street, New York, has had installed in front of his office a large electrically illuminated set of false teeth which are made to open and close in a most realistic manner. The upper jaw is supported by a steel frame projecting from the face of the building and guyed by chains and wires. The lower jaw is hinged to the upper one and is counterweighted so that very little power is required to move it on its hinges. Concealed by the upper jaw is a ⅛-hp motor connected through reduction gears to an eccentric which causes the jaws



ELECTRICALLY ILLUMINATED AND OPPERATED DENTAL SIGN

to open and close. Thirty sockets containing 10-watt lamps are staggered around each jaw. The jaws are made of molded zinc, the spread of them being about 3 ft. The Federal Sign System (Electric) manufactured the mechanism.

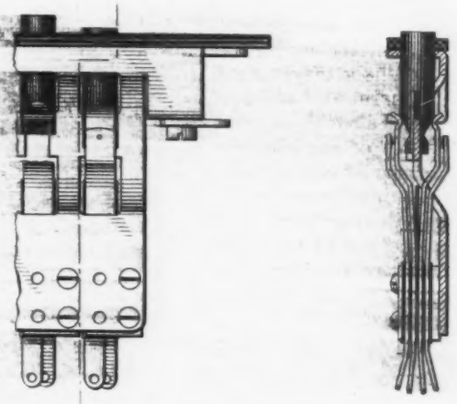
Recent Telephone Patents

A relay patented by Mr. John Erikson, Chicago, exhibits a novel method of adjustment. The movable part which presses the contact springs together consists of an angle piece, one leg of which holds an insulated block in contact with the springs, while the other leg is flexibly attached to the armature. An adjusting screw permits of tilting the armature with relation to the angle piece, thereby varying the air-gap and the throw of the movable parts. This patent is assigned to the Automatic Electric Company, Chicago.

To the Century Telephone Construction Company, Buffalo, N. Y., has been assigned a patent for a desk-stand telephone set which is the joint invention of Messrs. H. L. Knight and B. W. Sweet, of Cleveland, Ohio. The transmitter mounting, hook-switch lever and springs are all permanently mounted upon the main stempiece. In the final assembly of the apparatus a tubular shell is slipped over this stem from below and a sheet-metal base piece secured in position by a lock ring screwed onto the end of the stem piece where it protrudes through the base.

Improved Apparatus

Herewith is shown a simple form of calling-circuit key designed to be manufactured in strips. It will be noted that a single punching serves for the foundation of the



CALLING-CIRCUIT KEY

strip, including support for the cup piece, for the mounting lugs and for guides for the button. Furthermore, the set of springs may be assembled individually and then mounted. This key has been patented by Mr. J. N. Williams, of La Crosse, Wis., and assigned to the Western Electric Company.

Mr. J. J. Comer, of Chicago, has invented a double-acting granular transmitter. The middle part of the carbon diaphragm is confronted on both faces with a circular granule chamber. These are lined with a fibrous material the edge of which extends beyond the walls of the chamber. The contact with the diaphragm for retaining the granules is made by the fiber. The diaphragm is therefore free to vibrate. The front granule chamber is concentric with the bore of the mouthpiece, but it is surmounted by a cone, and a row of holes outside the button admits sound waves to the diaphragm. This patent is assigned to the Automatic Enunciator Company.

A party-line attachment has been invented jointly by Messrs. F. M. Wolf and R. M. Austin, Monroe, Wis., which taps off the number of any station when the hook switch is raised, thus informing those using the line of any interlopers.

Letter to the Editors

Systems of Charges for Energy

To the Editors of the Electrical World:

SIRS:—In the first portion of Mr. Tomlinson's letter in your issue of April 11, he deals with unmeasured service and generally condemns the system, because it is "based upon the clearly unjustifiable principle which is only known as expediency."

I am fully aware that in the United States, in the early days of electricity supply, practically all energy was supplied on the unmeasured system, whereas in this country, from the beginning, practically all supplies were metered.

Now, the occupiers of middle-class and upper-class premises, both residential and business, are users of electric light where a supply is available and funds will permit of the necessary installation, but there are hundreds of thousands of small cottages and one, two and three-room tenements in blocks which have puzzled central-station engineers, and are puzzling them still, to devise a system of charge which will rake in this enormous and valuable long-hour lighting business.

A measured rate is out of the question. Such consumers could not be relied upon to pay monthly bills; they would not pay a deposit to cover such monthly bill, and the consumption in kilowatt-hours is so small per consumer that a meter rent must be charged, or a high rate per kilowatt-hour made to cover the investment and depreciation cost of the meter and the accountancy, clerical and meter-reading proportion of the undertaking's expenses attributable to such small consumer.

Another method of measuring service is by means of a "coin-in-the-slot" prepayment meter. This has all the disadvantages of the straight meter rate in that it restricts the use of energy, piles up the big peak, and in addition the investment costs, depreciation and repairs are greater than with the ordinary watt-hour meter.

A third method of measured rate is to make a weekly primary charge per installation and a secondary rate (prepaid) of, say 1d., or 2 cents, per kw-hr. This still brings in investment and depreciation costs on the meter, which the consumption of this class of property will not stand, according to my experience. There is no question that in order to handle this business efficiently and with a view to obtaining the greatest income at the smallest cost and insuring the highest load-factor an unmeasured rate is the only method to adopt.

A system which is on trial in many districts at the moment, and which from my own experience here will probably be considerably extended in the near future, is an unmeasured rate based on the following foundations:

(a) The supply authority wires the property (either by its own staff or by contractors) by agreement with the owners. This is only done where the owners are substantial people enabling a ten-year agreement to be entered into, resulting in the amortization of the investment within that period.

(b) The supply authority furnishes the lamps and maintains the installation.

(c) The charge for energy is based on the supply authority's cost, plus profit, assuming twenty-four hours' use per day of the supply. In many cases this could be profitably undertaken at 1 cent per kw-hr. at 100 per cent load-factor.

(d) A weekly sum is charged the consumer, payable in advance, which can be collected by the owner's agent at the same time that he collects the weekly rent, the supply authority allowing, by arrangement with the owner, a collecting commission to the agent.

(e) In some cases this weekly sum is included in the rent, as far as the tenant is concerned no distinction being made between the cost of light and rent charge. The owner's agent in these cases hands over the electric-light proportion of the rent to the supply authority.

(f) The weekly charge referred to consists of: (1) A sum calculated to pay back to the supply authority the cost of the installation in ten years and the interest combined; (2) a sum calculated to repay the supply authority for the supply of lamps (which are, of course, always tungsten) and repairs and maintenance of the installation; (3) a sum for energy used, based on, say, twenty-four hours' use per day at 1 cent per kw-hr. This provides for waste in the use of energy.

In some cases, after experience, it has been found that the hours per day of calculated use per lamp can be cut down to ten or eight, at the same time raising the calculated basis cost per kilowatt-hour. This is especially the case in blocks of tenements, where the owner's agent can check waste and exercise a considerable amount of supervision over the occupiers.

In Marylebone we have had a block on this system for some years, and the average receipts per kilowatt-hour are a fraction under the revenue we should have received had the supply been on our "telephone" or "measured differential" system of charge. The cost of replacements of lamps, repairs of installation and amortization of capital come out better than estimated.

Under these conditions we avoid all meter costs and also clerical costs incurred in respect to billing and collection, the whole system being on a cash basis. We are now making offers to owners of other property on the same lines. The installation costs of the experimental block were much greater than would be the cost of work carried out to-day, as we have obtained greater experience.

I object to Mr. Tomlinson's terms "monadic," "diadic" and "triadic." These simply add confusion to the rate terminology which already exists. I think it is preferable to stick to the definitions of the rate research committee of the National Electric Light Association, which surely cover all requirements.

There are really only three measured systems—the flat rate per kilowatt installed or per kilowatt of maximum demand, the straight meter rate, and the differential system. The latter I consider to be the only correct system where a measured system can be used, and I agree that it should be used except in the case of the small property I have already referred to.

I am afraid the investment charges on what Mr. Tomlinson calls the "triadic" system will be considerable, which will not matter in the case of large consumers, but will be very important in the case of consumers whose revenue amounts to not more than a few dollars per month. It necessitates the installation of a maximum-demand indicator, a watt-hour meter and a time meter, or a combination of all three.

Finally, I believe the ideal basis of rates to be the time-honored Hopkinson system. Where the size of the consumer is too small to warrant the installation of a watt-hour meter and maximum-demand indicator, the maximum demand can be assessed and only the kilowatt-hours need be measured. A classification of consumers will deal with the time element, which is obviously of great importance from the diversity-factor point of view, but with all large consumers there is no difficulty in applying Mr. Tomlinson's "triadic" system, as the revenue per consumer is sufficiently great to warrant the installation of apparatus to take into consideration the kilowatt-hours, maximum demand and time.

A. HUGH SEABROOK,
General Manager Borough of St. Marylebone Electric Supply.
St. Marylebone, England.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Electric Hoisting Equipment for Erecting New Quebec Bridge

The new Quebec bridge which is being constructed across the St. Lawrence River at Neilsonville, Canada, 9 miles above Quebec, will be erected with the help of two huge electrically operated hoisting towers. The bridge is to be of the cantilever and suspended center-span type, the distance between the centers of piers being 1800 ft. The length of the suspended span is 640 ft. and the length of the anchor arms is 515 ft., the total length of the bridge being 3239 ft.

For the erection of each cantilever there is provided an erecting tower, which is supported on a cantilever itself and is moved out toward midstream as the bridge structure is extended from the shore line. The towers are constructed of steel, are 200 ft. high and weigh about 840 tons each.

Motor Installation

Twenty-six motors, aggregating 752 hp, are employed on each tower for hoisting. On each of the four corners of the tower is a 90-ft., 15-ton motor-driven derrick hoist. On top of the tower, about 350 ft. above the river, are two traveling cranes carrying 55-ton main hoists and auxiliary gantry cranes. Each gantry crane is equipped with two 5-ton hoists. All movements are performed by electric drive except the bridge travel of the gantry cranes. The main erecting towers are moved along the cantilevers by utilizing two of the 50-hp motors normally driving the 15-ton derrick hoists.

About 1600 hp is required to operate the electrical equipment used in erecting the bridge. High-potential energy is delivered to substations on each side of the river from different hydroelectric systems. A submarine cable ties together the two substations, each of which is capable of operating the entire electrical equipment used in constructing the bridge. The energy is converted to 250 volts, direct-current form, before being utilized. Direct-current apparatus is used exclusively on the erection towers because it affords better control and permits of dynamic braking. As an illustration of the amount of energy obtainable from one of the main hoists lowering its maximum load through the maximum distance, sufficient heat would be generated in any type of friction brake to melt 100 lb. of iron. Instead of using friction brakes, therefore, the motors are operated as generators when braking, and the energy which is pumped back is dissipated in cast-iron grids installed at the base of the tower. For regulating the various motors employed about 5376 grids are required.

MOTOR EQUIPMENT OF ONE ERECTION TOWER

Kind of Crane	Service of Motor	Number of Motors	Hp of Motor
15-ton derrick hoist	Hoist	4	50
	Swing	4	5
55-ton main traveler	Hoist	4	80
	Bridge	2	16
	Trolley	4	5
5-ton auxiliary gantry	Hoist	8	20
Total		26	752

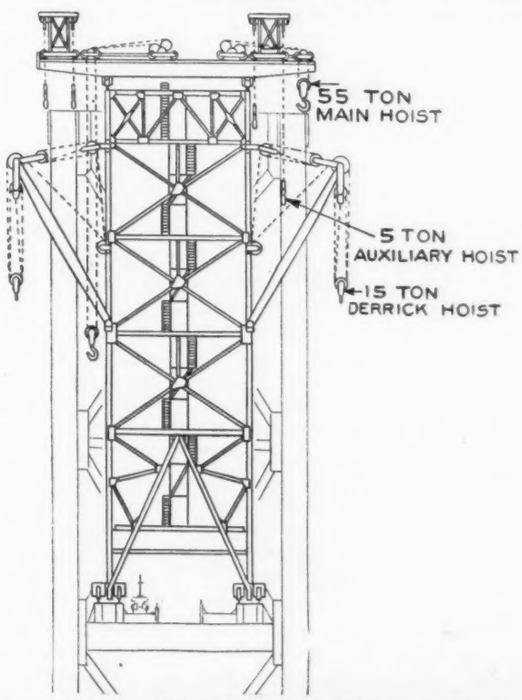


FIG. 1—END VIEW OF ERECTING TOWER

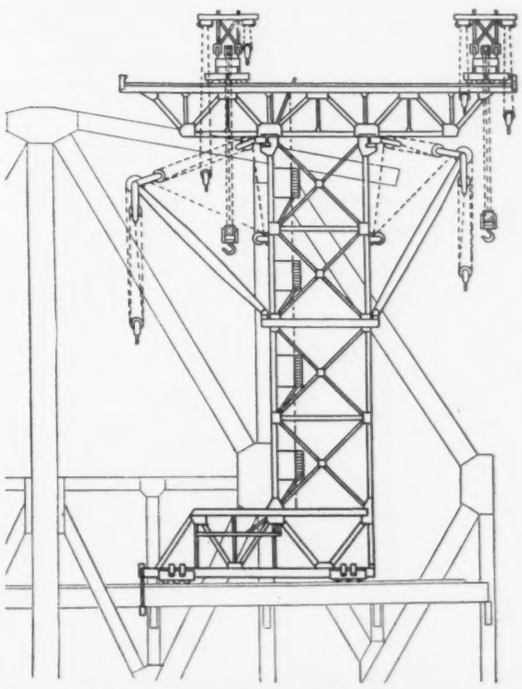


FIG. 2—SIDE VIEW OF ERECTING TOWER

which if placed end to end would extend over a distance of 242 ft.

For holding loads stationary magnetic brakes are employed. Some of the hoists are provided with travel-limit mechanisms. Switchboards 16 ft. long are erected in each hoisting tower. Six men will be stationed on the operating platform and two on each main crane where they can control the electrical equipment by master switches. A complete telephone system is installed on each tower with permanent connections on shore so that communication can be held between widely separated workmen. An electrically operated passenger elevator serves the various floor levels of each tower.

The contract for erecting the bridge is held by the St. Lawrence Bridge Company. The electric control apparatus employed in the erecting towers was furnished by the Electric Controller & Manufacturing Company, Cleveland, Ohio.

The Frank Confession of a Small-Plant Manager

In his paper entitled "A Trip Through a Small Plant," read before the recent convention of the Missouri Public Utilities Association, Mr. F. M. Wilkes, Poplar Bluff, Mo., outlined some of the conditions existing in his engine room prior to a trip through the station in company with the president of the organization. The same difficulties prevail in many other plants, and a study of the following extract from the paper may lead to betterment:

"At first view the engine room looked all right to me," said Mr. Wilkes, "but in a few minutes I found that I was using too much oil, that the dust should be blown out of the fields of the alternator, that the commutator of one of my exciters had a high piece of mica in it and should be grooved to prevent sparking, and that my belts were too tight and could be run more loosely, thus reducing the strain on the bearings of both the prime mover and the generator. Any slipping which might occur when the belt was slack could be avoided, I learned, by using a little fuller's earth to remove the oil and then applying a dressing of one part mutton tallow to one part neatsfoot oil, thus increasing the adhesion and pliability of the belt. I also found that we were using too many wiping rags and that we had two steam leaks starting on the steam line. The time to stop these leaks is, of course, when they are first starting and not after they have commenced cutting fittings to such an extent that it is difficult to make new gaskets hold. Aside from these defects the plant looked to be in fairly good condition.

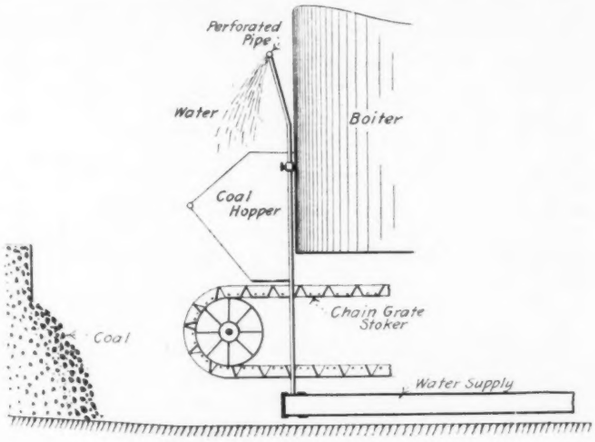
A Look Behind the Switchboard

"However, when we went over to the switchboard we found that all the other dirt and rubbish not already discovered—including three old rectifier tubes, two or three old belts, some burnt-out fuses, a can of paint, two bags of cement, four or five lengths of pipe, some very oily wiping rags, etc.—were piled away behind the switchboard, which stood about 24 in. from the wall. Here this material was out of the way of everything except an arc from the arresters or fuses. This was probably the most criminal of all the things done, or left undone, around the plant, for an arc on the back of the average board in a small plant is only too apt to take all the wiring on the board with it, and there was the additional danger of setting fire to the very inflammable material conveniently stored by the engineer in this out-of-the-way nook.

"This ended the inspection of the plant, leaving me with a clearer insight into the condition in my station, which, if remedied, would go further toward increasing its efficiency than many thousands of dollars spent in automatic stokers, smoke-consuming apparatus, voltage regulators, etc."

Wetting Coal in Stoker Hoppers

A central-station company in central Illinois, finding that it was almost impossible to get too much water on the grade of coal used under its boilers, has equipped each unit with a mechanical sprinkler. Water is led to the face of the bank of boilers along the floor of the boiler room in a supply pipe. From this source a riser



PIPING FOR COAL SPRAYER

is conducted to the horizontal perforated pipe running along the face of the boilers above the hoppers.

While the coal is on the boiler-room floor it is sprinkled with water from a hose, and after the firemen have shoveled the hopper full the valve on the riser is opened, permitting more water to be sprinkled on the fuel. The coal itself is of a fair grade but rather fine, and the water has been found to reduce the number of holes forming in the fire.

Feed-Water Purification

To what extent can preheating feed water purify the water for boiler use? H. L. B.

When the boiler-feed water contains foreign substances which can be precipitated at temperatures produced during the preheating process, it may not be necessary to employ other means of purification. On the other hand, water sometimes contains in solution chemical compounds which cannot be precipitated or removed even at the boiling point or at any temperature to which water can be subjected in the feed-water heater. In such cases if the feed water foams, pits the boiler or deposits scale therein, it is necessary to neutralize the injurious substances by adding some chemical which should be selected only after careful quantitative and qualitative analysis of the water. Boiler compounds should not be added unless it is definitely known that (1) the injurious substances will be rendered unharmful thereby, and (2) that no new deleterious chemicals are formed. Among substances commonly used for purifying boiler feed water are sodium hydroxide, calcium hydroxide, soda ash, trisodium phosphate, compounds of tannin and starchy materials.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Oil-Cooled Transformers.—A note on a recent British patent (No. 24,162, 1913) of H. Weiss. To prevent the deleterious effects which are due to the presence of air above the surface of the oil, this specification describes a means by which the transformer case can be completely filled with oil. An outlet pipe communicates with a vertical cylinder in which a weighted piston works. When the oil expands the piston rises. The weight of the piston serves to maintain a pressure in the transformer casing, which effectively prevents the cooling liquid from leaking into it through the material of the cooling coils.—London *Elec. Eng'ing*, May 28, 1914.

Lamps and Lighting

Half-Watt Nitrogen-Filled Tungsten Lamp.—H. LUX.—An illustrated account of an extended investigation of a 1000-cp nitrogen-filled tungsten lamp. In spite of the high light output of the half-watt lamp as compared with the ordinary tungsten lamp, the transformation of electric energy into light does not show any particular advance. Out of the total radiated energy 8 per cent is light, but only 4.8 per cent of the total consumed energy is changed into light. This is due to the fact that considerable energy losses are resulting from heat conduction. These are relatively much greater than in evacuated lamps. Further, within the closely wound filament coil there are also light losses. The principal results of the investigation are given in the accompanying table. The author finally discusses what would be the limit to which the efficiency of the tungsten lamp can be driven. This is evidently at the melting point of tungsten, about 3200 deg. absolute temperature. The author finds that this would be reached with a specific consumption of about 0.3 watt per mean spherical hefner candle.—*Elek. Zeit.*, May 28, 1914

DATA ON NITROGEN-FILLED TUNGSTEN LAMP

Power Demand, Watts	Total Radiation, Watts	Total Radiation in Per Cent of Power Consumption	Light Radiation		Light Radiation in Per Cent of Total Radiation	Light Radiation in Per Cent of Power Consumption	Heat Radiation per 100 Cp in Watts
			Watts	Spherical, Cp			
236.6	155.1	65.6	3.12	133.0	2.010	1.32	133
264.6	171.1	64.8	5.46	178.0	3.019	2.06	93
326.4	208.4	63.9	7.42	296.3	3.560	2.27	68
391.5	242.1	61.9	12.16	468.5	5.020	3.11	49
457.0	280.0	61.3	18.67	686.2	6.680	4.09	38
524.7	315.8	60.2	25.30	926.2	8.040	4.82	32

DATA ON ORDINARY OSRAM LAMP

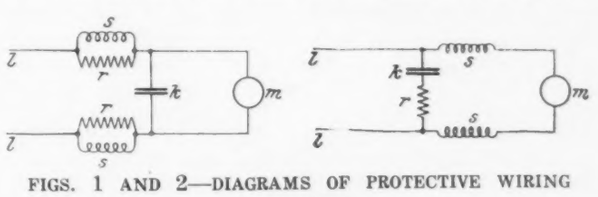
94.6	83.4	88.2	3.14	64.2	3.76	3.32	125
102.4	90.4	88.3	3.79	79.0	4.41	3.70	103

Photometric Units.—A. P. TROTTER.—A paper read before the (British) Illuminating Engineering Society. The author discusses critically certain proposals made by a sub-committee of the American Illuminating Engineering Society regarding the definition of certain photometric magnitudes. The question of the best symbols to use for these magnitudes is also dealt with. The author refers especially to the definitions of lumious intensity, illumination, brightness and coefficient of reflection. An account of the discussion which followed is also given.—London *Electrician*, May 29, 1914.

Light Signals.—C. O. HARRINGTON, JR.—A long illustrated discussion of the optics of light signals and of the most efficient distribution of light for railway signals giving day and night indications. After discussing the elements of railway signaling, the author takes up the light signal, the use of the incandescent lamp and its influence on light signal design, the use of lenses and reflectors and phantom indications, the relation of candle-power to the range of light signals, the distribution of light, the reduction in candle-power at night and the color of signals.—*Journal Frank. Inst.*, April and May, 1914.

Generation, Transmission and Distribution

Protection Against Traveling Waves.—REINHOLD RUEDENBERG.—Neither condensers alone nor induction coils alone furnish reliable protection against traveling waves. In order to get perfect protection it is necessary to combine a self-inductance with a capacity and an ohmic resistance. The ohmic resistance is necessary because in it the energy of the traveling wave must be annihilated. The ohmic resistance of the protecting device should be about equal to the characteristic of the line loop to be protected. That self-inductance and capacity are to be used together follows from the consideration that a self-inductance coil reflects a traveling wave with unchanged sign while the capacity reflects the wave with reversed sign. The capacity and the inductance must be so proportioned that the two waves reflected with opposite signs counterbalance each other. An effective protective method based on these principles is shown in Fig. 1, in which the machine m is to be protected by means of the condenser k and the inductance coils s which are in parallel with the resistances r. During normal operation the current passes through the inductance coils s and is little affected by the resistances r and the condenser k. But when a rapid traveling wave arrives it cannot pass through the self-inductances s, but passes through the resistances r and is reflected by means of the condenser k so that it has to pass again through the resistances r. If the self-inductance and the capacity were infinitely large, the energy of the traveling wave would be completely an-



FIGS. 1 AND 2—DIAGRAMS OF PROTECTIVE WIRING SCHEMES

nihilated in the resistance. In reality only a very small amount of the wave is permitted to pass or to be reflected. Another arrangement based on the same principle is shown in Fig. 2. The condenser k is here in series with the resistance r, while s represents inductance coils. A protective arrangement for use at the

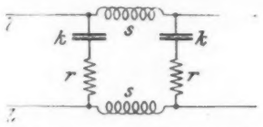


FIG. 3—DOUBLE PROTECTIVE ARRRANGEMENT

point where cables are connected with an overhead line is shown in Fig. 3. This is essentially a double arrangement by which both the overhead line and the cable are protected against each other.—*Elek. Zeit.*, May 28, 1914.

Installations, Systems and Appliances

Buying Energy in Bulk Versus Isolated Plant.—WALTER STRAUS.—The conclusion of his long paper in which the author gives detailed calculations as to the conditions under which it is more economical for a factory to buy energy in bulk from a central station than to have its own isolated plant. The calculations are based on the rate schedules of various German central stations. It is shown that in very many, although not in all, cases connection to a central station is more advantageous. The author finally criticises the rates made by many central stations. The rate of a central station for a large consumer should be arranged in such a way that the cost to the consumer is less than the cost of energy generation in an isolated plant. On the other hand, the charge must be sufficiently higher than the cost to the central station in order to yield a proper profit. The author thinks that most German rates are much too low for short periods of operation and low load-factors. Consumers could pay much higher rates and would still be better off than with their own isolated plants. For long hours of operation various tariffs like that of the Rhenish-Westphalian Electricity Works are quite good, while others are much too high; for instance, the tariff of the Berlin Electricity Works. The result is that in Berlin many isolated plants are in existence. Other weaknesses of rates of German central stations are discussed. If a rate is to be devised according to the cost of energy generation in an isolated plant, it should be based on the following considerations: The consumer should pay a fundamental rate per maximum kilowatts (this corresponds with interest and amortization of an isolated plant). To this is to be added a charge depending on the maximum kilowatts and the time of operation (this corresponds to wages and lubrication in isolated plants). Finally, a charge is to be made per kilowatt-hour, depending also on the kilowatts and on the average load (this corresponds with the expense for fuel in isolated plants). A rate based on such calculations should then be adapted to the cost of power generation in the central station itself, and this could easily be done. Every central station should try to eliminate isolated plants altogether from the districts to which it supplies service.—*Elek. Zeit.*, May 28, 1914.

Electrophysics and Magnetism

Magnetic Properties of Manganese Steel.—SIR ROBERT HADFIELD AND B. HOPKINSON.—An abstract of a paper read before the (British) Iron and Steel Institute. Manganese steel containing about 12 per cent of manganese and 1.25 per cent of carbon, when prepared in the ordinary way, is practically non-magnetic, but if heated to a high temperature and slowly cooled it can be rendered magnetic. Samples heated for long periods at temperatures in the neighborhood of 500 deg. C. were tested magnetically at intervals (by a differential method, which compared their permeability with that of a standard piece of nearly pure iron) and were found to exhibit a gradual rise in permeability, according to a curve asymptotic to a constant value varying with the temperature. Quenching the specimen did not destroy the magnetic quality thus created, but further heating at temperatures exceeding 640 deg. C. resulted in a diminution of the magnetic quality at a rate more rapid the higher the temperature, until at 750 deg. C. the magnetic properties were practically removed in a few minutes. At intermediate temperatures the magnetic quality does not entirely disappear, but ultimately settles down to constant reduced value. The material in the ordinary non-magnetic condition, or in the magnetic condition induced by prolonged heating at 520 deg. C., is unchanged by immersion in liquid air, but in an intermediate condition, after short heating at 500 deg. C., it is rendered more magnetic by immersion in liquid air. Cold working makes the water-toughened material slightly magnetic. Heating and cooling curves showed a change point at about 650 deg. The explanation of these effects appears to be that the stable form of the alloy at temperatures below about 750 deg. C. is more or less magnetic, the proportion of magnetic substance present in the equilibrium state diminishing rapidly when the temperature approaches that figure. Above 750 deg. C. the magnetism disappears. From about 650 deg. C. to 750 deg. C. there is a critical range similar to that corresponding to the loss of magnetism in ordinary carbon steel. If the alloy be cooled from above this critical range, the tendency, as it passes through any lower temperature, is toward the attainment of the amount of magnetism proper to that temperature. But the rate of approach to equilibrium is so slow that even when the cooling takes several minutes only very little of the magnetism is restored, and the effect produced is similar in kind to that produced by quenching a carbon steel. The important effect of the manganese is, apparently, this retardation of the attainment of the equilibrium, rather than any very marked shift of the position of the critical range.—London *Elec. Eng'ing*, May 21, 1914. A longer illustrated abstract in London *Electrician*, May 29, 1914.

Electrochemistry and Batteries

Electrometallurgy of Iron and Steel.—S. GUGGENHEIM.—The author first gives a review of the different electric-steel furnaces and the development of electric-steel processes and shows the difficulties which are in the way of rapid development. He then discusses briefly the reduction of pig-iron from ores in the electric furnace.—*Elek. Zeit.*, May 14, 1914.

Electric Steel from Ore.—E. HUMBERT AND A. HETHEY.—An abstract of a paper read before the (British) Iron and Steel Institute. The authors describe the production of steel direct from ore by means of an electric furnace and give details of tests on steel made direct from different ores. They discuss fully the advantages of the process.—London *Electrician*, May 22, 1914.

Forces Between Atoms and Chemical Affinity.—SIR J. J. THOMSON.—A highly theoretical paper in which the author shows that chemical compounds may be divided into two principal classes. In one class the atoms are electrically neutral; in the other they are charged, some positively, others negatively. The properties of compounds are strikingly different ac-

cording to whether they belong to one class or to the other. The author discusses the chemical effects produced by the electric fields arising from intra-molecular ionization, the number of active molecules which a molecule of a different kind can hold in combination, and the conditions required for the existence of a chemical compound. He also develops a new theory of valency. He regards the negatively electrified corpuscles in an atom as arranged in a series of consecutive layers. Those in the inner layers are supposed to be so firmly fixed that they do not adjust themselves so as to cause the atom to attract other atoms in its neighborhood. There may, however, be a ring of corpuscles near the surface of the atom which are mobile and which have to be fixed if the atom is to be saturated. The number of corpuscles of this kind may be anything from 0 to 8, but when the number reaches 8 the ring is so stable that the corpuscles are no longer mobile and the atom is, so to speak, self-saturated. The number of these mobile corpuscles in an atom of an element is equal to the number of the group in which the element is placed according to the Mendeleef classification. Thus helium and neon have no free corpuscles; hydrogen, lithium, sodium, potassium, each 1; beryllium, magnesium, calcium and strontium, 2; boron and aluminum, 3; carbon and silicon, 4; nitrogen, phosphorus and arsenic, 5; oxygen, sulphur and selenium, 6; fluorine, chlorine, bromine and iodine, 7. The bonds in the usual structural formulas of valency compounds are considered as tubes of forces.—*Philos. Mag.*, May, 1914.

Units, Measurements and Instruments

Vibration Electrometer.—H. GREINACHER.—If a string galvanometer, such as has been used extensively in recent years for radioactive purposes and ionization measurements, is connected to a source of alternating current of moderate frequency, the string begins to vibrate in synchronism with the alternating current. The author shows how the Wulf double-string galvanometer can be used as an electrometer. He also discusses its employment in the Wheatstone bridge and its application to measurements of capacities and dielectric constants and to the observation of alternating magnetic fields and alternating electric fields. Some notes are added on the construction of a vibration electrometer. —*Elek. u. Masch.* (Vienna), May 17, 1914.

Telegraphy, Telephony and Signals

Magnifying Relay.—An English translation in abstract, with illustrations, of E. Reisz's German paper on the Lieben magnifying telephone relay.—London *Elec. Review*, May 1, 1914.

Automatic Telephony.—An illustrated description of the new semi-automatic telephone exchange of the city of Dresden in Germany.—London *Elec. Rev.*, May 29, 1914.

Miscellaneous

Export Trade of the United States.—LUDWIG W. SCHMIDT.—A statistical article in which it is pointed out that the electric export trade of the United States has increased from 1908 to 1913 by about $5,000,000. These advances have been made chiefly in North America and South America, while the export trade to Europe and Asia has decreased. The electric export trade of the United States has undergone considerable fluctuations during this period. The author thinks that the electrical export trade of the United States will concentrate itself chiefly on the American, and perhaps on the Australian, market, and will gradually give up the European market, while nothing can yet be said concerning Asia and Africa.—*Elek. Zeit.*, April 30 and May 7, 1914.

Air Condensers.—G. SEIBT.—An illustrated article in which the author describes some new designs of variable-capacity air condensers.—*Elek. Zeit.*, May 7, 1914.

Integrating the Amount of Light.—H. S. HATFIELD. —The author describes a method of integrating the amount of light received from a variable source—for example, the sun—for a long period. For this purpose the photoelectric alkali cell is used in combination with the hydrogen voltameter described in the Digest last week.—London *Electrician*, May 22, 1014.

Electricity Meters.—The regulations of the German Association of Electrical Engineers as to the requirements which electricity meters and measuring transformers must fulfil in order to be officially certified.—*Elek. Zeit.*, May 21, 1914.

The Telephone as Oscillograph.—MANNIE SIEGBAHN. —An account of experiments made to determine whether the telephone with a normally working current intensity can be used to register variable currents. An instrument is described by which it is possible to reproduce the variation of the membrane of the telephone with the required accuracy, and the sources of error are discussed. Diagrams are shown giving a reproduction of the currents through the telephone in some simple cases, and the general conclusion is reached that the telephone cannot be utilized for oscillographic purposes. *Philos. Mag.*, May, 1914.

Book Reviews

ELECTRICAL ENGINEERING PROBLEMS. Part I, Direct-Current Circuits and Apparatus. Part II, Alternating-Current Circuits and Apparatus. By Prof. F. C. Caldwell. New York: McGraw-Hill Book Company, Inc. 106 pages. Price, $1.

A book of arithmetical and algebraic problems in electrical engineering subjects, suitable for use in technical colleges. The work is divided into two parts, each comprising fifteen different sections. There are altogether about 800 problems offered for solution. Appended to each problem is an estimate of the time needed for its solution. The problems are of a practical engineering character. The book will be of value to instructors in electrical engineering courses and also to students who desire to develop their own powers of analysis.

PHOTO-ELECTRICITY. By Arthur L. Hughes. New York: G. P. Putnam's Sons. 144 pages, 40 illus. Price, $2.

An interesting and full résumé of researches made during the last few years into the nature of the photo-electric effect. The effect itself has become known only during a very few years, so that the accumulation of so much experimental and theoretical material in so short a time is remarkable. The book relates to the following topics: Ionization of gases and vapors by ultra-violet light; the velocities of emission of photo-electrons; the total photo-electric effect; the photo-electric effect as a function of the frequency and state of polarization of the light; photo-electric properties of thin metallic films; photo-electric effects of non-metallic elements and inorganic compounds; photo-electric effects of dyes, fluorescent and phosphorescent substances; positive rays produced by light; sources of light used in photo-electric experiments. The book will be of interest to students of optical physics and of photometry. It is clearly written and shows the mark of careful study.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Single-Phase Watt-Hour Meter

A single-phase induction-type watt-hour meter with all the working parts rigidly attached to a single integral casting is being placed on the market by the General Electric Company, Schenectady, N. Y. The base or central iron casting of this instrument supports the complete motor element on the inside and the damping magnets, bearings and registering mechanism on the outer or front side. An extension at the bottom forms the terminal box. The leads enter the bottom of the box, the brass terminals being permanently molded into place in a non-combustible insulating compound.

INDUCTION WATT-HOUR METER

The rotating element consists of an aluminum disk mounted on a vertical shaft with a worm cut in the upper end, which transmits motion to the worm wheel at the back of the register. The lower shaft bearing is a sapphire mounted in a brass screw, which is readily accessible. A brass cap is screwed on over the end of the jewel screw and acts as a guide, preventing the pivot from jumping out of the cup in the event of some disturbance in the circuit.

The magnetic circuit is in two sections rigidly fastened together by two punched-iron reinforcing plates. There are two current poles and one potential pole. Three screws hold the entire element in position inside the base. The permanent magnet, by means of which the speed of the disk is regulated, is made up of two individual magnets astatically arranged and mounted in a brass shoe. The system is supported by a shelf on the main casting and provided with micrometer adjustment. Turning the screw clockwise draws the magnet out and decreases the speed of the disk.

Two holes punched diametrically opposite in the disk prevent creeping or turning on potential alone. A lagging device, consisting of a rectangular copper punching in the form of a short-circuited loop and attached to the light-load plate, compensates the instrument for inductive loads. The meter is tested and adjusted at a power-factor of 50 per cent. It is built in ratings from 5 amp to 300 amp for two-wire circuits and from 5 amp to 150 amp for three-wire circuits.

Electric Iron with Automatic Temperature Control

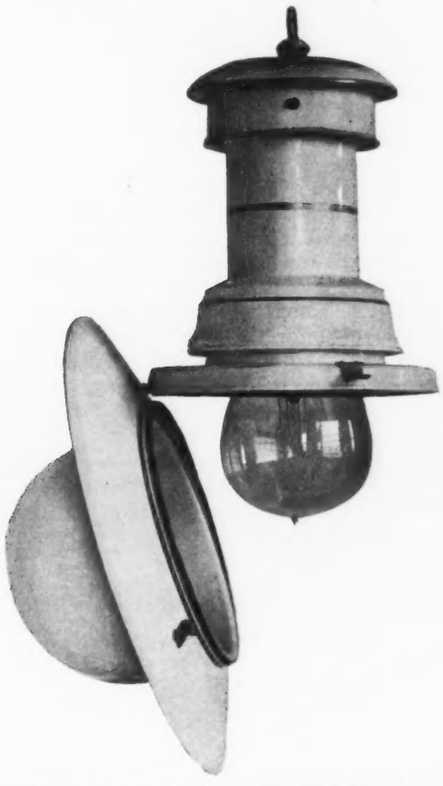
A novel feature of automatic uniform heat control is incorporated in the electric iron illustrated herewith. By means of the thumb-nut at the rear this iron can be set to maintain itself at any temperature between 300 deg. Fahr. and 600 deg. Fahr. A platinum point on the thermostat bar makes contact with a similar contact point the position of which is adjustable by turning the black insulated thumb-piece. As the temperature of the iron rises the expansion of the bar causes the contact to be broken. A mica-and-foil condenser, mounted near the front of the iron, is bridged electrically across the contact points and practically eliminates altogether the arc of breaking the 600-watt circuit. Ordinary ironing temperatures, according to the Dover Manufacturing Company, Canal Dover, Ohio, maker of the electric iron described, range about 450 deg. Fahr. The automatic control adjustment thus affords a wide range of operating temperature which can be set according to the character of the work.

The resistor element employed in this "A-best-o" automatic iron is a nickel-chromium ribbon embedded in a special insulating composition which has the desirable property of combining high thermal conductivity with its value as an electrical insulator. After the ribbon is put in place the insulating composition is baked at 1300 deg. and becomes both hard and tough, resisting fracture or tendency to crack. One of these heating elements is reported to have been operated continuously for six months at a cherry-red temperature without showing signs of injury. This automatic electric iron has been approved by the Underwriters.

FLATIRON WITH AUTOMATIC HEAT CONTROL

Ventilated Holder for High-Efficiency Tungsten Lamps

A ventilated holder for outdoor use with gas-filled tungsten lamps is shown herewith. It is an adaptation made from the five-mantle gas lamp. The ventilation is sufficient, the manufacturers claim, for any nitrogen-



VENTILATED HOLDER FOR NITROGEN-FILLED LAMPS

filled lamp now on the market. The accompanying table gives a comparison of the heat generated by five-mantle gas lamps and high-efficiency tungsten lamps.

The globe is made of clear white glass which is said to show no spots or filament lines. A 0.25-in. hole is

RELATIVE HEAT GENERATED BY GAS AND INCANDESCENT ELECTRIC LAMPS

Light Source	Illuminant	Cubic Feet or Kw-hr. per Hour	Lb.-Fahr. Heat Units per Hour	Relative Heat Liberated
Five-mantle gas lamp	Natural gas	11-15	12,100-16,500	0.85-1.15
Five-mantle gas lamp	Artificial gas, pressure 2.6 in.	22	14,300	1
750-watt nitrogen-filled lamp	Electric	0.750	2,560	0.18
1000-watt nitrogen-filled lamp	Electric	1.000	3,420	0.24

drilled in the bottom of the globe. This globe rests on an asbestos ring placed inside the shade holder, which consists of an annular ring supported at three points by means of a hinge and two set-screws. No set-screws touch the glass itself. The shade holder can be swung down on a hinge to renew the lamp or clean the glassware. Use is made of a special socket so designed that it is unnecessary to bring the wires in through a cap at the top of the binding posts. The holder is finished in black or white enamel. The bottom of the annular ring which supports the glass is always white-enameled. This holder is being manufactured by the Multi-Lux Illuminating Company, Cleveland, Ohio.

Porcelain Rosette and Sign Receptacle

The porcelain rosette shown in Fig. 1 is for use with outlet boxes only. Pass & Seymour, Inc., Solvay, N. Y., makers of the device, manufacture it in two sizes, one for use with a 3.25-in. box and the other with a 4-in. box. The hole in the cap is arranged to take the so-called fixture loops, permitting the rosette to be used with a chain. The line terminal screws are easy to get at and are long and "upset." Fig. 2 shows an exploded view of a sign receptacle which is designed so that it will not turn after being placed in position.

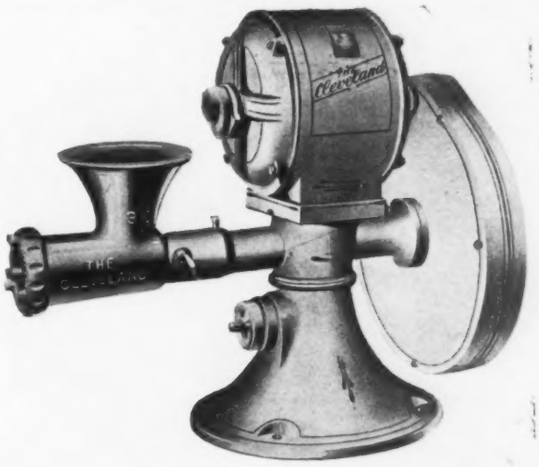
FIG. 1—PORCELAIN ROSETTE

FIG. 2—SIGN RECEPTACLE

Five notches are provided as shown in the illustration. One projection only is used, and this projection can be bent down into any of the five notches for practically any position of the receptacle desired, thus insuring against turning.

Motor-Driven Meat Chopper

A compact electrically operated meat chopper is shown in the accompanying illustration. All working parts are inclosed. The height of the machine is 23 in., the width 16 in. and the length 28 in. It weighs 240 lb. With a 0.5-hp motor this machine is designed to

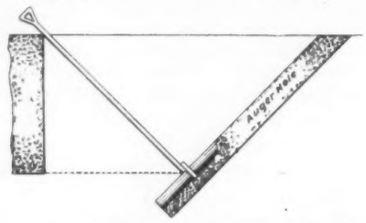


ELECTRIC MEAT CHOPPER

chop 350 lb. of beef per hour and with a 0.75-hp motor 375 lb. per hour. The chopper can be removed and placed in a cooler when desired so that cleaning after every operation is unnecessary. This meat chopper is being made by the Cleveland Electric & Manufacturing Company, Cleveland, Ohio. It is driven by a Westinghouse inclosed motor.

Anchor That Bears Against Undisturbed Earth

Guy anchors as a rule have been designed to be set with the pull rod in the strain position. An anchor recently placed on the market by the Chance Manufacturing Company, Centralia, Mo., involves a new prin-



ANCHOR DESIGNED TO PREVENT CREEPING

ciple whereby the anchor plate is made to bear on undisturbed earth. This anchor, which is known as the "Never Creep," is made in two pieces, a pull rod and an anchor plate.

As shown in the illustration, the hole in the earth is bored with an ordinary 8-in. auger and as nearly at right angles to the line of strain as conditions will allow. The depth of the hole varies with the length of the rod used. After the hole is dug the pull rod is driven through the undisturbed earth to the center. The anchor-plate is then lowered into the hole and set on the end of the pull rod by means of a special hook casting fastened to the end of a tamping bar. The slot in the anchor plate is tapered so that it will slip over the end of the pull rod without difficulty. The released plate assumes a position in which the anchor-head socket engages the head of the pull rod, thereby holding both securely in place. It is claimed that this anchor has a greater holding power than a "deadman" of the same area, and at the same time is much more quickly and easily installed. The manner of attaching the pull rod to the anchor plate is also considered advantageous because there are no threads; consequently the entire pull-rod section is available for anchor strains.

Apparatus for Portable Incandescent Lamp

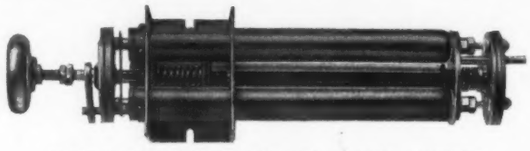
A socket with a combined reflector and guard mounted on a clamp for use with portable work lamps is being placed on the market by Mr. R. S. Mueller, 423 High Avenue, S. E., Cleveland, Ohio. The jaws

PORTABLE LAMP EQUIPPED WITH CLAMP

of the clamp have a spread of 2⅛ in. and can be applied to a bench or table as shown in the illustration, or to a pipe, rod, spoke, fender, wire or rope. A hook is provided at the end of the clamp for use where nothing is available to apply the jaws. When the lamp is used as a hand-lamp the clamp serves conveniently as a handle. The reflector is of nickel-plated steel. The socket, which is insulated from the clamp, contains a switch operated by a short hard-fiber knob. The socket turns so that the reflector may be rotated to throw light on the work and shade the eyes. Twenty feet of rubber-reinforced, waterproof cord is provided with this outfit, and use is made of a two-piece separable attachment plug. A 15-watt tungsten lamp is generally employed with this apparatus.

Speed Regulators for Slip-Ring Induction Motors

A compact speed regulator for slip-ring induction motors has been developed and is being placed on the market by the Allen-Bradley Company, Milwaukee, Wis. This regulator is of the carbon-compression type, the carbon disks being contained in steel tubes from which they are completely insulated. One of these tubes is provided for each phase. The resistance can be changed by varying the compressive force exerted on each pile of disks. This is accomplished by means of the hand wheel shown in the illustration. The regu-



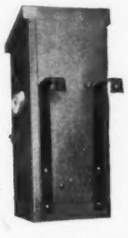
SPEED REGULATOR FOR SLIP-RING MOTORS

lator is so designed that the pressure is equalized in each tube.

With a regulator of this type any slight turn of the handle effects a change in the speed of the motor. Being inclosed in steel tubes, the resistors are not easily affected by moisture or acid fumes. For 50 per cent speed reduction this regulator is made for motors for far service, etc., with ratings up to 10 hp and for motors for machine operation up to 5 hp.

Lightning-Arrester Hangers

The hangers shown herewith are being manufactured by the Electric Service Supplies Company, Philadelphia, Pa., and are designed for supporting the Garton-Daniels lightning arresters made by this company. The style C hanger, shown in Fig. 1, is for installations between two cross-arms,



FIGS. 1 AND 2—HANGERS FOR TWO CROSS-ARMS AND FOR ONE CROSS-ARM

the upper part of the supports being bent to fit over the upper arm. The style B hanger, shown in Fig. 2, is for single-arm installations; it differs from the style C hanger in that the lower support of the latter is not used.

Jobber, Dealer and Contractor

Examination Board for Electricians in Kansas City, Kan.

A board of electrical examiners has been appointed in Kansas City, Kan., to examine all applicants for licenses. The board is made up of Messrs. H. C. Marshal, city electrician; E. A. Brown, an electrical contractor, and Edward Henschel, a former electrician. The applicants for licenses will bear the cost of examinations.

Westchester County Contractors Organize

Leading electrical contractors of Westchester County (N. Y.) have recently organized under the name of the Electrical Contractors' Association of Westchester County. Its membership covers contractors in Yonkers, Mount Vernon, Port Chester, New Rochelle, White Plains, Ossining, Tarrytown and other Westchester County towns. The officers of the association are: President, Mr. W. N. Barlow, Yonkers; first vice-president, Mr. F. E. Schmidt, Mount Vernon; second vice-president, Mr. I. W. Austin, White Plains; secretary, Mr. C. E. Youmans, Yonkers, and treasurer, Mr. Charles A. Sillery, Yonkers.

Threefold Co-operation Inaugurated in Indianapolis

An electrical appliance-selling campaign recently inaugurated at Indianapolis, Ind., seems to have produced that threefold co-operative spirit toward which jobbers, dealers and central-station men are striving in many other cities. Mr. N. A. Perry, manager of the Indianapolis Light & Heat Company, originated the idea, and in its operation the Varney Electrical Supply Company, the Indianapolis Electric Supply Company and the Western Electric Company are included as jobbers, and the following dealers are participating:

CO-OPERATIVE FAN DISPLAY AT INDIANAPOLIS

Sanborn Electric Company, Skillman Electric Company, Porter Electric Company and Hatfield Electric Company. All sharing in the plan have expressed themselves as highly gratified at the results obtained.

As the campaign is now being conducted the dealers purchase their stock of appliances from the three jobbers and consign a portion of it to the appliance sales department of the Indianapolis Light & Heat Company. The central-station company then employs several methods in disposing of the goods. Irons, as a rule, are sold by eight salesmen working for the lighting company, the selling price being $3.50. With the city divided into four districts these men canvass electric-service customers along the meterman's route and receive a commission of 50 cents for each sale. Each agent carries two samples of the same manufacture, it being the plan of the company to sell a different make of iron in each of the four districts. If a prospective customer desires a type of iron not being sold in her district, the agent takes the order and it is filled from the store by a motorcycle man who delivers irons as rapidly as the orders come in. When a customer takes advantage of the part-payment offer which has been made and elects to pay $1 down and $1 a month, the salesman collects the first $1 with the order and the remaining collections are made by the dealer. Turning in the $1 to the company, the solicitor receives his 50 cents and the remainder goes to the dealer supplying the iron. Some irons, of course, are sold in the store and some by the company's regular solicitors. The commissions in these cases revert to a fund to be expended for advertising at the discretion of Mr. N. A. Perry. During the summer months the company expects to dispose of about 200 irons.

Fan and other appliance sales are handled almost exclusively from the lighting company's appliance store. This business is generally dispatched on a cash basis, and 10 per cent of the gross revenue is retained by the lighting company for its advertising fund. The jobbers have agreed to do no retail appliance business, and with the dealers fixing the retail price charged by the lighting company the chain of co-operation is complete. Lamps and industrial motors are not included in this appliance sales campaign.

Building Managers Want Lead-Covered Wires

The Building Managers' Association of Chicago is endeavoring to induce the city government to modify the rules and regulations of the Department of Gas and Electricity to permit the use of lead-covered wires in downtown office buildings instead of the steel-conduit construction specified. The elemental objection to the conduit is not the expense but the fact that it is sometimes difficult to install it without breaking the fireproofing. The matter is pending in the City Council committee on gas, oil and electric light. Mr. Ray Palmer, city commissioner of gas and electricity, is opposing the proposed change.

Louisville Electrical Contractors Adopt Open Shop System

Following the lead of other employers of labor, the leading electrical contractors of Louisville, Ky., have announced that they will operate hereafter on the open-shop system. Heretofore the electricians' union has had the bulk of the work there, and the announcement of the employers amounts practically to a lockout, for the reason that the rules of the unions will not permit their members to work in any other than closed shops. The Moore-Young Electric Company, Frazer & Bush and the Builders' Supply Company are the contractors who took the lead. Other trades in which a similar condtiion exists are the carpenters, the barbers, the plasterers, the painters and the plumbers.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Business in Ball Bearings Good.—From present indications it is declared that the business of the Hess-Bright Manufacturing Company, Philadelphia, Pa., this year will be the best the company has ever enjoyed.

Electrical Equipment for Government Service.—Orders have recently been received from the United States government for nineteen directly connected generating sets and eleven switchboards by Engberg's Electric & Mechanical Works, St. Joseph, Mich.

Storage Batteries for Headlamp Service.—An order has been received by the Electric Storage Battery Company, Philadelphia, Pa., from the Southern Pacific Railroad Company for 650 sets of "Ironclad Exide" batteries for locomotive headlamp service. With the previous order received several months ago, this makes a total of 946 sets, or 2838 cells, for this class of service.

Poster Stamps for Advertising Purposes.—Poster stamps are a German advertising novelty. They have recently been introduced into this country, and among the firms to make use of them is the Westinghouse Lamp Company. The stamps measure 2 in. by 1.5 in. in size, and they are used on the backs of envelopes, packages, etc. Various attractive color designs are printed on these stamps.

Extension from Grinnell, Ia.—The Grinnell (Ia.) Electric & Heating Company, which is controlled by the Federal Light & Power Company of Boston, and of which Mr. H. C. Utter is the local manager, has obtained a franchise for supplying electrical energy in Brooklyn, Ia., a village of 1000 population, which has hitherto had gas for lighting and heating but no electricity. Energy will be transmitted from Grinnell over a line about 18 miles long.

Summer Central-Station Service to Private Plants.—Contracts have just been signed by Mr. Robert Montgomery, commercial manager for the Louisville Gas & Electric Company, to furnish the Galt House and the department store of the Herman Straus & Sons Company with electricity for lamps and fans this summer. Both these concerns maintain their own plants and run these in the winter in connection with their heating systems.

Tool Manufacturer Moves to Larger Factory.—Moving into its new factory at Belmont and Kedzie Avenues, Chicago, the firm of Mathias Klein & Sons now occupies a modern and much larger plant. The new building is situated on a 6-acre tract, and the factory, including the company's power house, has approximately 65,000 sq. ft. of floor surface. With recent additions to its force, the company now employs 133 men making tools for linemen.

Mica Business Fair.—The business of Eugene Munsell & Company, 68 Church Street, New York, is reported to be fair, and a spirit of optimism regarding the future is manifest. The calendar year 1913 is said to be the best this concern has ever had. The mica marketed by this company is obtained chiefly from India and Canada, although a certain amount is also taken from the United States. The Canadian amber mica is declared to be the best for commutator insulation.

Orders for Gas Engines.—Orders have recently been received by the Bruce-Macbeth Engine Company for the following equipment: One 60-hp twin-cylinder natural-gas engine for the Mirroscope Company, Cleveland, Ohio; one 40-hp two-cylinder engine for the West Virginia Central Gas Company, Weston, W. Va.; one 60-hp twin-cylinder natural-gas engine for the Delaware Blue Limestone Company, Delaware, Ohio; one 40-hp natural-gas engine for the A. H. Jackson Company, Sandusky, Ohio; two 150-hp four-cylinder natural-gas engines for the Hardwicke-Etter Company, Sherman, Tex., and one 60-hp two-cylinder gas-engine for C. W. Downey's garage, Cleveland, Ohio.

Violet-Ray Sterilization for Niagara Falls' Water Supply.—The first municipal ultra-violet-ray sterilizing plant to be installed in this country is now being constructed at Niagara Falls, N. Y., and will be completed about Sept. 15. Thirty-five "pistol" lamps will be employed, seven being used in each of five concrete canals. Of this number, however, only about twenty-five will be actually required to handle the 16,000,000 gal. pumped by the plant daily. The canal and sterilizing-lamp installation will cost about $20,000, and it is estimated that during operation the energy cost will be about 7 cents per 1,000,000 gal. The equipment is being constructed by the R. U. V. Company, Inc., New York.

Reducing Number of Pending Patent Applications.—Considerable progress has been made in reducing the number of applications pending for the issuance of patents, according to Hon. Thomas Ewing, Commissioner of Patents, in a recent report to Secretary Lane on the output of the work of his office since he assumed charge last August. Commissioner Ewing states that since Jan. 1 the number of applications passed for the issuance of patents exceeded by 6987 the number granted for the corresponding period last year. Since last August the number of new applications awaiting action has been reduced by 539 and the number of old cases by 5152, a total reduction in pending cases of 5691. Receipts of the Patent Office for the first five months of this year were $968,376, compared with $910,531 for the same period last year. Receipts last year were $157,000 in excess of expenses, and the commissioner says this year's surplus will be more than $200,000. Since its establishment the receipts of the Patent Office have been more than $10,000,000 in excess of expenses.

Annual Report of Federal Sign System (Electric).—As chairman of the board of directors Mr. Samuel Insull reported to the stockholders of the Federal Sign System (Electric) for the fiscal year ended March 31, 1914, the report being issued on June 10 last. The chairman of the board reports gross income from operation for the year ended March 31, 1914, as $1,988,260. The expenses were $1,815,488, leaving $172,781 as net income. From this $141,059 was deducted as the 7 per cent dividend on the preferred stock, leaving $31,722 as the balance carried to surplus. In his report Mr. Insull makes the following interesting comment on the business of the company: "Generally the company has continued its policy of developing its merchandising business, but without diminishing the line of its own manufactures, to which it has added several new articles. Light and power companies continue to be its principal customers. The company's gross sales have increased substantially, but it has found that its customers have this year confined their purchases largely to staple apparatus and supplies essential to their regular business, on the sale of which your company makes but a medium profit. Customers have been inclined to defer until a period of more plentiful money the purchase of electricity-consuming devices, in the sale of which your company makes its best profit. During the year the company has opened one new office, at Toronto, Canada, making a total of twenty-four offices." The total surplus of March 31, 1914, was $217,646. The company's outstanding capital stock consists of $2,045,400 in preferred and $3,110,150 in common. The general office is in Chicago, but there are branch offices in New York, Philadelphia, St. Louis, Pittsburgh, Baltimore, San Francisco, Minneapolis, Toronto and fifteen other cities. The officers of the company, beside Mr. Insull, are as follows: President, Mr. John H. Goehst; treasurer, Mr. John F. Gilchrist; secretary, Mr. James M. Gilchrist; general manager, Mr. Herbert I. Markham; general auditor, Mr. J. S. Macpherson.

Electricity for Coal Companies.—A recent electric-service contract of interest is that by which the Wallings Creek Coal Company, the Clover Fork Coal Company and the Harlan Coal Mining Company have agreed to get their energy supply from the Kentucky Utilities Company, whose headquarters are at Lexington, Ky. To give this service, the company before the end of the present summer will run a transmission line into the Hazard section, while the mining companies which heretofore have generated their own energy will discontinue their isolated plants. At least one of them, it is said, will use the machinery in the operation of an ice factory.

Central-Station Business in the Atlantic States.—Official returns for the month of April from central stations operating in the Middle Atlantic States indicate a rather better rate of increase over 1913 than was shown by the figures for the previous month. From the comparative data for this territory for March and April shown in Tables I, II and III, it will be seen that throughout the three states of New York, New Jersey and Pennsylvania the expansion characteristic on both earnings and output is higher for April than for March. Although the figures in the accompanying tables have been derived from the official returns of the operating companies, they should not be taken to mean that there has been any marked improvement in the industrial situation in the East, as the expansion for March seemed unduly low. The returns for April will at least have the effect of leveling up the 1914 monthly average, so that the first six months of the year should show an increase over 1912 of from 8 to 9 per cent on the gross earnings. Even the higher figure would be appreciably below normal, but before the industry can enter upon any fresh boom period and again register annual increases in the neighborhood of 13 or 14 per cent a very marked change must take place in the industrial situation generally. At the present time the electric utilities are busy but business is not booming. From the first three tables it will be noted that operating companies sometimes report a rising revenue with a falling output. Last month the reverse was the case. Too rigid a comparison of the two quantities should never be attempted, since the station output is totaled for a calendar month, while the revenue is based on meter readings, and the monthly totals for such readings never correspond strictly to the calendar month. It should be stated that the gross earnings from the sale of energy for the entire industry in the Middle Atlantic States for April were probably a little in excess of $10,000,000. Data gathered by the *Electrical World* show that the gross earnings of thirty-one companies in this belt increased from $5,257,092 in April, 1913, to $5,769,418 in April, 1914, or at a rate slightly less than 10 per cent; while the energy output increased from 189,904,240 kw-hr. to 209,156,581 kw-hr., or at a rate of just over 10 per cent. For the South Atlantic States (Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia and Florida) it is again found that a higher rate of increase over last year was shown by April than by March. Comparative returns for the two months are given in Table IV, from which it will be noted that the total gross earnings from the sale of electricity by ten central-station companies was 12.7 greater in April of this year than in April, 1913, energy output having increased in the same time by 26.1 per cent. Comparable figures for March showed 10.7 and 25.0 per cent. If an addition is further made of the companies reporting April figures but from which data were not received for March, it is found that in the South Atlantic belt the gross earnings of seventeen companies increased from $928,664 in April, 1913, to $1,058,320 in April, 1914, or at a rate of 14 per cent; while the energy output increased from 41,176,414 kw-hr. to 50,532,426 kw-hr., or at a rate of 22.8 per cent. It should be borne in mind that the entire industry in this group of states showed an output for April, 1914, of a little over 100,000,000 kw-hr., for which it received probably around $1,750,000.

TABLE I—EARNINGS AND OUTPUT FOR MARCH AND APRIL, 1914 AND 1913, FOR SEVENTEEN LARGE CENTRAL STATIONS IN NEW YORK STATE

	Gross Earnings from the Sale of Energy			Total Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
March	$3,708,765	$3,489,352	6.3	112,580,788	107,844,478	4.5
April	3,577,519	3,313,347	8.0	107,131,606	101,381,741	5.7

TABLE II—EARNINGS AND OUTPUT FOR MARCH AND APRIL, 1914 AND 1913, FOR EIGHT LARGE CENTRAL STATIONS IN THE STATES OF PENNSYLVANIA AND NEW JERSEY

	Gross Earnings from the Sale of Energy			Total Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
March	$1,894,955	$1,792,602	5.7	98,262,459	88,499,066	11.1
April	1,943,913	1,733,836	12.2	95,211,713	82,740,110	15.1

TABLE III—MIDDLE ATLANTIC STATES—EARNINGS AND OUTPUT FOR MARCH AND APRIL, 1914 AND 1913, OF CENTRAL STATIONS REPRESENTING OVER ONE-HALF OF ENTIRE INDUSTRY OF NEW YORK, NEW JERSEY AND PENNSYLVANIA

	Gross Earnings from the Sale of Energy			Total Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
25 companies (March)	$5,603,720	$5,282,154	6.1	210,843,247	196,343,544	7.5
31 companies (April)	5,769,418	5,257,092	9.8	209,156,581	189,904,240	10.1

TABLE IV—SOUTH ATLANTIC STATES—EARNINGS AND OUTPUT FOR MARCH AND APRIL, 1914 AND 1913, OF TEN CENTRAL-STATION COMPANIES

	Gross Earnings from the Sale of Energy			Total Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
March	$938,939	$848,951	10.7	43,086,047	34,451,793	25.0
April	901,639	799,672	12.7	41,665,255	32,978,594	26.1

NEW YORK METAL MARKET PRICES

	June 9 Bid	June 9 Asked	June 16 Bid	June 16 Asked
Copper				
Standard spot*	13.00	13.40	13.25	13.75
	Selling Prices		Selling Prices	
	£ s d		£ s d	
London, standard spot*	61 17 6		61 10 0	
Prime Lake	14.12½	to 14.37½	14.12½	to 14.25
Electrolytic	13.85	to 13.95	13.80	to 13.90
Casting	13.70	to 13.80	13.65	to 13.75
Copper wire base	15.25	to	15.00	
Lead	3.90		3.90	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	7.00		7.00	
Spelter, spot	5.10	to 5.20	5.10	to 5.20
Tin, spot*	30.50	to 30.75	30.00	to 30.25
Aluminum:				
Prompt delivery	17.75	to 18.00	17.75	to 18.00
Future	17.75	to 18.00	17.75	to 18.00

***OLD METALS**

Heavy copper and wire	12.62½	12.87½
Brass, heavy	8.50	8.62½
Brass, light	7.37½	7.50
Lead, heavy	3.70	3.75
Zinc, scrap	4.00	4.15

***COPPER EXPORTS**

Total tons to June 16 17,708

*From daily transactions on the New York Metal Exchange.

Corporate and Financial

Midland Counties Public Service Corporation.—This corporation, which was organized under the laws of California on Oct. 11, 1913, has acquired the properties of the Coalinga Water & Electric Company, the Midland Counties Gas & Electric Company, the Paso Robles Light & Water Company and the Russell Robinson Light & Water Company.

Westinghouse Electric & Manufacturing Company.—At the annual meeting of stockholders of the Westinghouse Electric & Manufacturing Company, held at the general offices of the company in Pittsburgh, Messrs. A. G. Baker, William McConway, George M. Verity and Paul M. Warburg were re-elected directors, while Messrs. John R. McCune, H. H. Westinghouse, Paul D. Cravath and James N. Wallace were elected to fill vacancies in the board.

American Gas & Electric Company's Extra Dividend.—At the recent meeting of directors of the American Gas & Electric Company, besides the regular quarterly cash dividend of 2 per cent, an extra dividend of 2 per cent payable on July 1, 1914, in common stock was declared. It will be the policy of the company to distribute such portion of its earnings as may be available for that purpose above the requirement of the regular cash dividends in the form of common stock dividends. The company, however, does not commit itself as to the date of declaration or rate of future stock dividends.

Columbus Electric Company Notes.—Eastabrook & Company, of Boston, Mass., have purchased a new issue of $1,750,000 three-year 6 per cent notes of the Columbus (Ga.) Electric Company, operated by Stone & Webster. These notes are being offered at 99 and interest yielding 6¾ per cent. The proceeds of these notes will provide funds for retiring $1,000,000 of 5 per cent coupon notes dated July 1, 1914, and the floating debt incurred for new construction. The Columbus Electric Company owns the securities of companies which do the entire electric-railway, electric-lighting, gas and power business in the city of Columbus, Ga., and vicinity, and in the adjoining towns of Phoenix and Girard.

Texas Southern Electric Company Merger.—The Texas Southern Electric Company has been organized under the laws of Massachusetts and has purchased electric properties at Cuero; the electric and ice properties at Victoria; the electric, ice and water properties at Bishop, Kingsville and other south Texas cities. The transaction, with contemplated improvements, represents $1,000,000. Warner, Tucker & Company, of Boston, financed the transaction, and Mr. W. A. Leland, president of the Tennessee Eastern Electric Company, is president. Messrs. W. B. Tuttle and B. G. Slining, of the Southwestern Engineering Company, of San Antonio, Tex., were prominent in the engineering, financing and organization of the merger.

Ohio Service Company.—The Ohio Public Utilities Commission has authorized the Ohio Service Company to issue securities aggregating $1,489,807, and to acquire the property of the electric companies in Dennison, Uhrichsville, Canal Dover, New Philadelphia, Coshocton, Cambridge and Pleasant City. The commission, however, does not approve the prices which are to be paid for the plants. The companies to be acquired with prices to be paid are as follows: County Electric Company, having plants at Canal Dover, Dennison, Uhrichsville and New Philadelphia, $694,000; Lafayette Light & Power Company, transmission lines between these towns, $45,807; New Midland Power & Traction Company, having electric plant at Cambridge and an interurban line between Cambridge and Pleasant City, $750,000.

Annual Report of Associated Gas & Electric Company.—The fourth annual report of the Associated Gas & Electric Company has been published. The company is under the management of the J. G. White Management Corporation. For the year ended Dec. 31, 1913, the gross earnings from operation were $774,818. Deducting $549,410 for operating expenses and taxes leaves $225,408 as net revenue from operation. To this is added $53,913 as income from other sources, making the gross income $279,321. Subsidiary companies' deductions amounted to $97,827, giving $181,494 as the balance available for the company. After deduction of $112,807 for interest and $39,627 for dividends, $29,060 was left for surplus. Adding $25,100 for profits on sale of securities of Bethlehem Consolidated Gas Company and subtracting $17,600 for amortization of debt, discount and expense leaves as surplus for the year $36,560. During the year $95,823 was expended for improvements and $41,000 was expended for maintenance.

Virginia Power Company Bonds.—A. B. Leach & Company, of New York, are now placing on the market the $3,300,000 issue of first and collateral trust mortgage 5 per cent gold bonds of the Virginia Power Company which they bought. Many of these bonds have been sold, and the remainder are being offered at the rate of one thousand-dollar bond and three shares of common stock for $900. These bonds are thirty-year bonds dated Dec. 1, 1912. Since that time they have been held as collateral for notes. These notes are to be called in at an early date. The issue is secured by an absolute first mortgage on a modern steam-power plant at Cabin Creek Junction, W. Va., having a capacity of 26,666 hp and an ultimate capacity of 53,332 hp. The bonds are further secured by 129 miles of transmission and distribution lines, by water rights and lands between Bluestone and the Virginia state line, and by the outstanding capital stock of the New River Power Company and the Dominion Power Company of Virginia. The three power sites which the company controls on the New River are at Bluestone, Richmond Falls and Hawk's Nest, W. Va. The estimated available power from Bluestone is 125,000 kw, from Richmond Falls 15,000 kw and from Hawk's Nest 30,000 kw—a total of 170,000 kw.

Southwestern Cities Electric Company's Plans.—Mr. John C. Keys, of Lawton, Okla., president of the Southwestern Cities Electric Company, states that the company is contemplating the purchase of a number of plants in that district. So far it has nearly completed the transmission line in Texas which is to tie all of the Texas properties together, supplying them from one plant, thereby eliminating the local plants in smaller communities. Mr. Keys further stated that it is hoped eventually to connect the Texas properties and most of the Oklahoma properties on one transmission line. At present changes are being begun at the Lawton property; Diesel engines and Westinghouse generators have been ordered to replace the present steam plant. The lines are being rebuilt and the entire plant and transmission system will be rehabilitated. At present the company controls the Chillicothe Light & Power Company, Chillicothe, Tex.; the Comanche Light & Power Company, Lawton, Okla.; the Duncan Electric & Ice Company, Duncan, Okla.; the Mangum Electric Company, Mangum, Okla.; the Pecos Valley Gas & Electric Company of New Mexico, and the Quanah Light & Ice Company of Quanah, Tex. The officers are John C. Keys, of Lawton, Okla., president; A. D. Converse, New York, vice-president; F. L. Search, Rochester, N. Y., treasurer, and A. H. Mosle, New York, secretary.

Pacific Gas & Electric Company Permanent Financing Plan.—A letter has been sent to stockholders of the Pacific Gas & Electric Company in which is set forth a plan for the permanent financing of the company. The stockholders are asked to approve of a charter amendment for reclassification of the stock into $100,000,000 common, $50,000,000 first preferred 6 per cent cumulative, and $10,000,000 first preferred. They are also asked to subscribe to $12,500,000 new preferred, which will be issued immediately at $82.50 per share, payable in instalments. To holders of the old $10,000,000 preferred is extended the right to exchange for new preferred, after July 1, 1916, at the rate of 10¼ shares of new preferred for every 10 shares of old. This is equivalent to an additional exchange value of $20.60 on ten shares. Upon consummation of the plan dividends on the common stock will be resumed at the beginning of 1915 at the rate of 4 per cent per annum. The present plan of capitalization for raising new capital has meant the issuing of short-term bonds, which have made it necessary to reinvest in the property an undue proportion of the earnings. This, coupled with the fact that the Railroad Commission of the State of California has indicated to public utilities that it views with disfavor the practice of raising new capital entirely from the sale of bonds, caused the board of directors to propose the new plan.

Business Notes

The Formica Insulation Company, of Cincinnati, Ohio, is now the name of the firm formerly known as the Electric Service Company.

Dodge Brothers, of Detroit, Mich., have appointed A. E. Barker, who was the founder and for many years the active head of the Dean Electric Company, Elyria, Ohio, their district representative, with headquarters at Cleveland. He will have charge of sales in sections of Ohio, New York, Pennsylvania, West Virginia and Maryland.

The Westinghouse Electric & Manufacturing Company.—On account of the increased activities of the railway and lighting department of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., two new positions have been created, and E. P. Dillon and M. B. Lambert have been appointed to fill these positions with titles of assistant managers. Mr. Dillon will have charge of the commercial activities of the company in connection with the generation and distribution of power, involving power houses, substations, transformer stations and similar apparatus. Mr. Lambert will have charge of all sales work pertaining to electric traction, including steam, interurban and city installations. Both Mr. Dillon and Mr. Lambert have been connected with the railway and lighting department of the above company for a number of years.

New Industrial Companies

The Mason Bouck Electric Company, of Binghamton, N. Y., has been incorporated with a capital stock of $5,000 by E. Mason, F. J. Mason and W. C. Bouck, all of Binghamton.

The United States Lightning Conductor Company, of Chicago, Ill., has been incorporated with a capital stock of $1,000 to manufacture and deal in lightning conductors. The incorporators are Mark L. Smith, William H. Bell and W. W. Huse.

The M. & F. Electrical Company, of Rock Island, Ill., has been incorporated with a capital stock of $2,500 to manufacture and deal in all kinds of electrical apparatus, machinery, etc. The incorporators are Martin McNealy, William McNealy and William Fox.

The American Electrical Display Company, of Cleveland, Ohio, has been incorporated with a capital stock of $10,000 to do a general electrical advertising business. The incorporators are Mrs. E. R. Blitz, Henry Baker, Max P. Goodman, M. E. Tettlebach and A. L. Dietz.

The Aladdin Electric Company, of Chicago, Ill., has been incorporated by Samuel P. Marmley, Jr., Norman C. Crosshaw and Joseph Bonomo. The company is capitalized at $10,000 and proposes to manufacture and deal in electrical and automobile merchandise, supplies, etc.

The Jeffries-Young Antenna Company, of Atlantic City, N. J., has been incorporated with a capital stock of $50,000 by J. L. Young, P. E. Lane, E. H. Cuthbert and J. W. Gallaway, of Atlantic City. The company proposes to manufacture equipment for wireless telegraphy, electrical apparatus, etc.

The Empire Electric Vehicle Company has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $200,000 and proposes to manufacture bicycles, wheeled chairs, etc. The incorporators are I. T. Conway, L. A. Brownhill and M. E. Dorsey, of Wilmington, Del.

The Anasco Asbestos & Asphalt Company, of Chicago, Ill., has been chartered with a capital stock of $50,000 to manufacture and deal in waterproofing, roofing, paving, paint and insulating materials, asbestos products, etc. The incorporators are Richard N. Simpson, W. Barrett Fitzgerald and E. R. Beifuss.

The Braun-Hoff Electric Company, of Canal Dover, Ohio, has been incorporated by W. A. Braun, Jesse D. Baker, S. L. Holmes, C. E. Kreiter, O. A. Keyser and E. B. Hoff. The company is capitalized at $50,000 and proposes to take over the property of the Dover Electric Company and will manufacture electric motors, generators, electric appliances and devices.

The Porter-Phonet-Scope Company has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,500,000. The company proposes to manufacture and sell phonetic apparatus for talking, singing and moving pictures. The incorporators are F. R. Hansell, of Philadelphia, Pa.; G. H. B. Martin and S. C. Seymour, of Camden, N. J.

The South Electric Manufacturing Company, of New York, N. Y., has been incorporated with a capital stock of $25,000 by William S. Lison, 165 Broadway; Charles R. Pedle, 165 Broadway, and Lewis C. Randolph, 206 Broadway, all of New York, N. Y. The company proposes to manufacture and deal in machinery and devices, and to do a general contracting, electrical and mechanical engineering business.

Trade Publications

Pull Sockets.—A leaflet describing in detail a new pull socket has been issued by W. R. Ostrander & Company, 22 Dey Street, New York.

Fans.—A neat, attractive booklet of forty-eight pages has been issued by the Western Electric Company to show the many types of fans made by this company.

Keyless Sockets.—W. R. Ostrander & Company, 22 Dey Street, New York, have issued a leaflet entitled "Socket Talks No. 3." It describes a new keyless socket put out by the above company.

Batteries.—The Willard Storage Battery Company, Cleveland, Ohio, has issued Bulletin No. 45, referring to various types of its LBA battery. Descriptions, illustrations and price-lists are given.

Axle-Lighting System.—In Bulletin No. 144 the Electric Storage Battery Company, Philadelphia, Pa., describes the fundamental principles of an axle-lighting system. It contains several photographs and a diagram of connections.

Rectifier.—The Wotton rectifiers, made by the Electric Products Company, Cleveland, Ohio, are illustrated and described in an eight-page pamphlet issued recently. Ignition, starting and lighting battery-charging equipments are fully discussed.

Pumps.—Bulletin No. 118 of the Goulds Manufacturing Company, Seneca Falls, N. Y., relates to centrifugal fire pumps. A comprehensive, illustrated description of this apparatus is given, together with instructions for installing and various useful tables.

Pole-Line Hardware.—W. N. Matthews & Brother, St. Louis, Mo., in a pamphlet of twelve pages illustrate and describe their new line of pole hardware called "Prisections." These devices, the invention of John L. Fay, have many practical features of interest to central-station men.

Cables.—The Belden Manufacturing Company, Twenty-third Street and Western Avenue, Chicago, Ill., in its Bulletin No. 1006 gives data on its line of standardized bare-copper cables and braids. A complete range of sizes is shown, including a new line of cables designated as the "Hawserlay" woven-rope effect.

Electric Vehicles.—In a pamphlet bearing the title "Good Store Service," the General Vehicle Company, Inc., Long Island City, N. Y., makes practical suggestions for laying out the delivery system of a department store and refers specifically to the value of the G. V. electric vehicles in solving department-store vehicle problems.

Copper Wire.—A recent issue of *Copper Gossip* contains a résumé of the copper-market situation, New York and London copper prices, the exports and imports of copper from January to April, 1914, and other copper news. This sheet is published periodically by the National Conduit & Cable Company, 41 Park Row, New York.

Storage Batteries for Locomotives.—A catalog describing the so-called "Ironclad-Exide" storage battery for locomotives has been issued by the Electric Storage Battery Company, Philadelphia, Pa. The book is illustrated with various types of locomotives using this type of battery. It also contains characteristic curves and tables giving dimensions and weights of different kinds of batteries used in this service.

Personal Mention

Mr. C. M. Means, of Pittsburgh, Pa., has been retained as consulting electrical engineer by the United States Bureau of Mines.

Mr. Edgar S. Nethercut, consulting engineer, of Chicago, will assist Mr. Harold Almert in making valuations of traction properties in the city of Washington and the District of Columbia.

Mr. H. H. Rice, vice-president and general manager of the Waverley Company, Indianapolis, Ind., was elected vice-president of the National Automobile Chamber of Commerce at its recent New York meeting.

Mr. C. B. Rhodes, formerly head of the motor-application department of the Kansas City Electric Light Company, is now industrial commissioner for the Mississippi River Power Company at Keokuk, Ia.

Mr. Tadahiko Ayai, manager of the Tokyo Electric Company, Ltd., of Japan, is spending two months in the United States studying American methods of incandescent-lamp manufacture. He attended the Philadelphia convention of the National Electric Light Association and will return to New York City for a stay of several weeks before sailing for Europe. Mr. Ayai expects to spend a month in England and three weeks in Germany and Switzerland before returning to Japan.

Mr. E. W. Lloyd, general contract agent of the Commonwealth Edison Company, Chicago, and newly elected first vice-president of the National Electric Light Association, sailed for Europe on the steamship *Imperator* June 6, in company with Mrs. Lloyd. During his trip to England and the Continent Mr. Lloyd expects to visit London, Paris, Berlin, Milan, Munich, Frankfort and other cities in France, Italy and Germany. Making the trip one of combined business and pleasure, Mr. Lloyd plans to inspect several electrochemical factories and steel mills where electric furnaces are being used extensively. He will return to this country by way of Liverpool about Aug. 1.

Mr. George Barton Muldaur, of the staff of Barclay Parsons & Klapp, has taken the position of "field representative" with the Society for Electrical Development, Inc. Mr. Muldaur was graduated from the Stevens Institute of Technology in 1889, and his first electrical experience was gained with the Edison Electric Illuminating Company of New York. He was associate editor of the *Electrical Engineer* for several years and World's Fair editor at the Columbian Exposition at Chicago in 1893. Of late years he has specialized as a development engineer in connection with new railway, light and power propositions, chiefly in the South and Southwest. This has included a great deal of publicity work both through newspapers and by personal contact with commercial bodies, city officials, financial organizations, etc. In his position as head of the field co-operative section of the Society for Electrical Development Mr. Muldaur will travel through the country, forming local co-operative leagues, establishing electrical pages in the newspapers with a view to intensive cultivation of the field by co-operative advertising, and organizing regular "get-together" meetings. These leagues will be posted on their local ordinances, particularly as regards wiring, inspection, rates, etc. Mr. Muldaur will also co-operate closely with architects and builders, with a view to having specifications written to provide for full electric service instead of merely for lighting. In addition, he will attempt to bring school textbooks and lecture courses up to date and will speak before chambers of commerce, boards of trade, etc., to urge local co-operation which will benefit the development of the electrical industry in general.

GEORGE B. MULDAUR

Mr. F. A. Gaby, chief engineer of the Hydroelectric Power Commission of Ontario, was married on May 20 to Miss Catherine Florence Macbeth, of Toronto, Ont.

Mr. A. H. Jones, who was elected president of the Mississippi Electric Association at its recent meeting at Meridian, Miss., resigned June 1 as manager of the McComb (Miss.) City Electric Light & Power Company. For the present Mr. Jones plans to take a much-needed rest.

Mr. R. E. Richardson, recently general manager of the Commonwealth Power Company, Kalamazoo, Mich., sailed for France, June 9, on board the steamship *New Amsterdam*. Mr. Richardson was formerly general manager of the Kansas City Electric Light Company, Kansas City, Mo.

Mr. Harold Almert, consulting engineer, Chicago, Ill., has been retained as technical counsel by the Washington Railway & Electric Company and the Potomac Electric Power Company, of Washington, D. C., to make a detailed inventory and valuation of the property of the companies in the District of Columbia.

Mr. Frederick A. Scheffler, the newly elected president of the New York Electrical Society, is one of the well-known pioneers of the electrical industry. He became associated with Mr. Thomas A. Edison in 1881 and as engineer designed for him the second electric locomotive built for experimental purposes at Menlo Park, N. J. Later Mr. Scheffler held such important positions as those of general superintendent of the Westinghouse Electric & Manufacturing Company's works, Pittsburgh, Pa.; general superintendent of the Brush Electric Company, Cleveland, Ohio, and manager of the Sprague Electric Company's factory, Watsessing, N. J. Mr. Scheffler was also connected with the introduction of the Stirling type of boiler manufactured by the Babcock & Wilcox Company, with which he is now associated. Mr. Scheffler has the rank of fellow in the American Institute of Electrical Engineers and is a member of the American Society of Mechanical Engineers and the Engineers' Club, New York.

Mr. L. R. Pomeroy, consulting engineer, who was recently appointed manager of the New York office of the United States Light & Heat Company, has long been engaged in work in the railway and electrical fields. He was born at Port Byron, N. Y., in 1857, and attended high school at Milwaukee, Wis., and the Irving Institute at Tarrytown, N. Y. From 1874 to 1880 he was engaged in commercial business, bookkeeping, special auditing, drafting and designing of cars and locomotives. From 1880 to 1886 he was secretary and treasurer of the Suburban Rapid Transit Company of New York. For four years following this he was a special representative of the Carnegie Steel Company, introducing basic boiler steel for locomotives and special forgings for railways. For nine years he was engaged in the same work with the Cambria Steel Company and the Latrobe Steel Company jointly. This assignment involved metallurgical engineering and experimental research to adapt special steels for railway axles, crank pins and piston rods. From 1829 to 1902 he was assistant general manager of the Schenectady Locomotive Works. For six years following this he was a special representative in the railway field for the General Electric Company, this work covering the electrification of steam roads and railway shops and the general application of electricity for all railway purposes. Subsequently he was for two years assistant to the president of the Safety Car Heating & Lighting Company, during which period he devoted a portion of his time to consulting work in the special field or railway shops and machine tool operation. From the Safety company he went with J. G. White & Company, New York, as chief engineer of the railway and industrial division. Before becoming associated with the United States Light & Heating Company he conducted a consulting engineering office in New York City.

L. R. POMEROY

Construction

New England

HAMPTON, N. H.—The Hampton Water Works Co., of Hampton, has engaged Charles N. Taylor, of Wellesley, Mass., to prepare plans and take charge of constructing a water-works system, consisting of about 12 miles of 6-in., 8-in. and 10-in. cast-iron pipe, standpipe, 25-in. in diameter and 85 ft. high, concrete pumping station, two pumps, each having a capacity of 300 gal. per minute, one to be driven by a 20-hp electric motor and the other to be driven by a 22-hp fuel-oil engine. William H. Jaques, Little Boar's Head, N. H., is president of the company.

WARREN, N. H.—Within the next four months the Warren Wtr. & Lt. Co. expects to purchase a 100-hp waterwheel and governor and material for 4 miles of 6600-volt transmission line and 1 mile of distribution line, 2300/110/220 volts. Edgar S. Carbee is treasurer.

BOSTON, MASS.—Bids will be received by the schoolhouse commissioners of the city of Boston, 120 Boylston Street, Boston, until June 23 for installing electric systems in the Andrews School, Genesee Street, Boston.

BROCKTON, MASS.—The Edison Electric Illg. Co. of Brockton has petitioned the Board of Gas and Electric Light Commissioners for permission to issue $316,200 in capital stock, the proceeds to be used to take up floating indebtedness and for further extensions to its plant.

FRANKLIN, MASS.—The Union Lt. & Pwr. Co., of Franklin, has applied to the State Board of Gas and Electric Light Commissioners for permission to issue $130,000 in capital stock, the proceeds to be used for extensions to its property.

GREAT BARRINGTON, MASS.—The Great Barrington El. Lt. Co. has been granted pole locations for a new transmission line as far south as Ashley Falls, through the village of Sheffield. The company proposes to furnish electricity in that section.

MANSFIELD, MASS.—The Municipal Electric Light Commissioners have entered into a contract with the Union Lt. & Pwr. Co., of Franklin, for the installation of a breakdown service at the Mansfield plant. A 13,000-volt line will be erected over a private right-of-way.

NORTH PROVIDENCE, R. I.—The electric light committee has decided to recommend to the Town Council the installation of electric lamps along Mineral Spring Avenue from Centredale to Marieville.

SMITHFIELD, R. I.—At a recent town meeting the taxpayers made appropriations for the installation of electric lamps on the main highways of the town of Smithfield as follows: For lamps in Esmond and Georgiaville, $1,000; for Greenville, $1,000, and $500 for Stillwater.

HARTFORD, CONN.—The municipal building commission has recommended the award of the contract for electric-lighting fixtures in the municipal building to the Tiffany Art Studios, of New York, at $21,600.

MANCHESTER, CONN.—Plans are being considered by Cheney Brothers for the construction of an electric power plant to furnish electricity to operate part of their silk mills and to furnish electricity to the Manchester Lt., Pwr. & Tramway Co.

MERIDEN, CONN.—The contract for installing underground conduit for the Meriden El. Lt. Co. has been awarded to the Lundin El. & Machine Co., of Boston, Mass. The contract calls for 6000 linear ft., equivalent to 60,000 duct ft., with about 30 manholes and 40 sub-manholes.

SEYMOUR, CONN.—The contract for erection of substation for transformers for the high-tension transmission line to be extended from Waterbury to Seymour has been awarded to William Harris. The building will be 50 ft. by 15 ft. and will furnish electricity for distribution in Seymour and Naugatuck.

WATERBURY, CONN.—The contract for mechanical equipment, consisting of light, heat and power plant, for the new municipal building has been awarded by the city hall commission to the George A. Fuller Co., of New York, N. Y., at $104,145.

Middle Atlantic

ARGYLE, N. Y.—Plans have been completed for the installation of a hydroelectric plant to furnish electricity for lighting the almshouse in Argyle, to cost about $3,500.

AUBURN, N. Y.—Preparations are being made by the Empire Gas & El. Co., of Auburn, for the erection of a 2300-volt transmission line between Seneca Falls and Auburn, a distance of 15 miles. The company will purchase line material of all kinds for the proposed line. L. C. Reynolds, general superintendent, will have charge of the installation.

BROOKLYN, N. Y.—The contract for installing electric equipment in new Public School 170 has been awarded to the Commercial Construction Co., 8 Bridge Street, New York, at $8,752.

BROOKLYN, N. Y.—The contract for installing electric equipment in new Public School 48 has been awarded by C. B. J. Snyder, superintendent of school buildings, to Eugene Frank, 22 East Twenty-first Street, New York, at $8,585.

BUFFALO, N. Y.—The City Council has adopted resolutions providing for replacing the cluster lamps on Genesee Street, between Main and Jefferson Streets, with 85 luminous-arc lamps.

NEW YORK, N. Y.—Contract for construction of Section 1-A of the Seventh Avenue subway has been awarded to the Rapid Transit Subway Construction Co. at $474,244 by the Public Service Commission.

NEW YORK, N. Y.—Plans and specifications have been completed for additional boiler plant, two 225-kw direct-current engine-driven generators, steam fitting and wiring, switchboard and sprinkler equipment for the addition to the Bonwit-Teller Building now being erected at 415 Fifth Avenue, 3-7 East Thirty-seventh Street and 8 East Thirty-eighth Street, New York. Howells & Stokes, 100 William Street, are architects, and Percival Robert Moses, 336 Fifth Avenue, New York, is consulting engineer.

NEW YORK, N. Y.—Percival Robert Moses, electrical engineer, and Frederick Pope, mechanical engineer, associate engineers, have awarded the general contract to the Turbine Equipment Co., 30 Church Street, New York, for remodeling the main factory and adjacent buildings of the Rock Plaster Mfg. Co. at 150th Street and East River, New York. This contract includes overhauling and retubing present boilers, grates, smokestack, steamfitting, turbine, generators, condenser, wiring, motors, induced-draft fan and engine and switchboard.

OGDENSBURG, N. Y.—The City Council has entered into a new contract with the Ogdensburg Pwr. & Lt. Co. for a period of five years, under the terms of which the company agrees to install cluster lamps in the business section of Ford Street. The contract provides for 136 arc lamps and 37 tungsten lamps.

PLATTSBURGH, N. Y.—The Plattsburgh Gas & El. Co. is extending its transmission line to the village of Morrisville, a distance of about 4 miles. The company has also secured franchises for extending its lines 8 miles further west to the village of Cadyville, and over all roads adjacent thereto. All line material and substation equipment has been purchased. George M. Cole is manager.

SPENCERPORT, N. Y.—At an election held June 3 the proposal to appropriate $16,000 for the installation of a municipal electric-light plant was carried.

JOHNSTOWN, PA.—The Citizens' Lt., Ht. & Pwr. Co., of Johnstown, it is reported, contemplates the construction of a large central power plant in Seward, 10 miles from Johnstown. The company is also planning to extend its service into Mineral Point, Echo and East Taylor townships.

PHILADELPHIA, PA.—Bids will be received by the building committee of the Marple-Newtown Joint High School until June 22 for the construction of a school building on the Marple-Newtown Township Line Road, Newtown Township; also for plumbing, heating and electrical work in above building. Plans and specifications may be obtained at the office of Lachman & Murphy, 933 Witherspoon Building, Philadelphia. John F. T. Lewis, 115 South Thirtieth Street, Philadelphia, or Broomall, is secretary.

SPRING CITY, PA.—Improvements are to be made to the County Home in Spring City, including the installation of a motor-generator set to supply electricity to operate the laundry machinery and other machines used about the county home. Energy for the system will be supplied by the municipal electric plant in Chambersburg.

WEST CHESTER, PA.—The installation of a municipal electric-light plant is under consideration. T. Lawrence Eyre, it is reported, has offered to give a perpetual lease of the water-power at his Deborah's Rock Farm, together with a waterwheel, capable of developing 100 hp.

ASBURY PARK, N. J.—The Ocean Township committee is planning to replace the present arc lamps with tungsten lamps throughout the township. There will be 65 lamps installed.

CLINTON, N. J.—The property of the Clinton El. Lt. Co. has been purchased by Charles S. Johann, consulting engineer, 50 Broad Street, New York, N. Y. The present plant will be dismantled and replaced by a modern power house. Mr. Johann also proposes to extend the present system to several nearby towns.

MORRISTOWN, N. J.—The Morris & Somerset El. Co. contemplates the installation of a 1500-kw turbo-generator set and new boiler equipment. The company is also considering the construction of a garage. J. H. Drake is treasurer and manager.

NEWARK, N. J.—The Board of Public Works, it is reported, has decided to enter into a contract with the Public Ser. El. Co. for a period of five years, under which a portion of the city will be lighted with nitrogen lamps. The company has offered to install 200 lamps at once and 500 during the year.

TRENTON, N. J.—Application has been made by C. S. Johann, consulting engineer, 30 Broad Street, New York, N. Y., and Frederick C. Simons, of New York, N. Y., to the Governor, for a charter for a company to conduct an electric-light and power business in the State of New Jersey. The company will be known as the Western New Jersey El. Lt. & Pwr. Co., and will operate an extensive electric transmission system covering several towns in the western part of New Jersey. The headquarters of the company will be at 50 Broad Street, New York, N. Y.

WOODBRIDGE, N. J.—Bids will be received by the Town Commissioners for lighting the streets of the town for a period of one year.

BUCKHANNON, W. VA. — Ernest Phillips, of Buckhannon, it is stated, would like to receive estimates on a generator with storage battery, with sufficient output to maintain 100 to 150 lamps, and gasoline engine.

SCOTFORD, W. VA.—The Coal Bell Coal Co., of Scotford, it is reported, contemplates the purchase of electric equipment, including electric mine fan, mining machines and electric locomotives.

WARWOOD, W. VA.—The contract for construction of a power house at dam No. 12, located near Warwood, has been awarded to Earl N. Everson, of Brilliant, Ohio.

ABINGDON, VA.—The City Council has granted the Abingdon Lt. & Wtr. Co. a franchise for a period of 30 years to furnish electricity for lighting the streets of the city and for commercial purposes. The company is planning to build a large dam and power plant at the middle fork of the Holston River, near Abingdon.

WASHINGTON, D. C.—Bids will be received at the office of the purchasing agent of District of Columbia, District Building, Washington, D. C., until June 23 for furnishing and installing a complete electric time and program system in the Normal School No. 2. For further information address the purchasing agent.

North Central

BATTLE CREEK, MICH.—The Commonwealth Pwr. Co. is planning to extend its transmission line from Battle Creek to Urbandale.

BOYNE CITY, MICH.—The Boyne City El. Co. is planning to install a new lighting system to replace the arc lamps now in use. The plans provide for the erection of 50 4-amp luminous lamps, at a cost of $3,500.

DETROIT, MICH.—Bids will be received at the office of Charles A. Gadd, secretary, Board of Education, 50 Broadway, Detroit, until June 23, for furnishing and installing four new boilers and stokers in the power plant at the Central High School building, situated at Cass, Warren and Hancock Avenues. Plans and specifications may be seen at the office of the supervisor of school buildings, 50 Broadway, Detroit.

GRAND RAPIDS, MICH.—The city engineer has submitted an estimate of the cost of installing an ornamental lighting system on West Leonard Street from the bridge to Fremont Avenue to the Sixth Ward Improvement Association, in which he estimates the cost at about $8,000. A committee will be appointed by the association to solicit funds for installing the system.

KALAMAZOO, MICH.—The City Council will consider bids on June 22 for the sale of the old municipal electric-light plant and equipment. The best offer previously made was $5,300, but it is thought that the plant should bring more.

LANSING, MICH.—The Reo Motor Car Co., of Lansing, is erecting a large addition to its plant. The company, it is reported, expects to purchase electric generating equipment.

WHITEHALL, MICH.—The Council is reported to be negotiating with the Grand Rapids-Muskegon Pwr. Co., of Grand Rapids, for energy to operate the municipal electric system.

WYANDOTTE, MICH.—At a special election to be held June 30 the proposal to issue $40,000 in bonds for improvements to the municipal electric light and water plants will be submitted to the voters. Of the proceeds $29,000 will be used for the electrical department. A. S. McClenehan is superintendent.

ATHENS, OHIO.—The City Council has decided to call an election July 18 to submit the proposal to issue $45,000 in bonds for a new electric light plant and $65,000 for water-works system.

CINCINNATI, OHIO.—The Andrew Jergens Co. is planning to build an addition to its factory, 99 ft. by 120 ft., four stories high, to cost $45,000. Considerable electrical equipment and supplies, it is understood, will be required.

CINCINNATI, OHIO.—Bids will be received by the director of public safety, City Hall, Cincinnati, until June 26 for furnishing material and labor necessary for the completion of the buildings on the Cincinnati Refuge Farm for Boys, located near Glendale, separate bids to be submitted as follows: (1) Lathing and plastering; (2) marble work; (3) electrical work. Plans and specifications and blank proposals can be obtained at the office of Tietig & Lee, architects, Lyric Building, Cincinnati. Edward P. Durr is secretary.

CINCINNATI, OHIO. — Contracts will soon be awarded by Henry Price for the construction of a four-story factory building, 83 ft. by 100 ft., for the N. Manichewitz Co., as an addition to its plant. Motors and other electrical equipment will be required.

CONNEAUT, OHIO.—The City Council is considering rebuilding the municipal electric-light plant, at a cost of $35,000. It is understood that an engineer will soon be engaged to take charge of the work. S. W. Mehaffey is director of public service.

GREENVILLE, OHIO.—The Greenville El. Lt. & Pwr. Co. has applied to the State Public Utilities Commission for authority to issue $28,000 in capital stock, the proceeds to be used for installing a new turbine engine and other improvements.

LANCASTER, OHIO.—The Lancaster Trac. & Pwr. Co. has been granted a franchise to construct and operate a street railway upon a number of streets in the city; also a renewal of its franchise upon the streets already occupied by the company for a period of 25 years.

MARION, OHIO.—Five petitions have been presented to the City Council asking for the installation of cluster lamps on Center and Main Streets.

MARTIN'S FERRY, OHIO.—Propositions have been submitted to the City Council by the Wheeling Trac. Co., of Wheeling, W. Va., and the Sunnyside El. Co. for furnishing electricity to operate the municipal electric-light system.

MASON, OHIO.—Improvements are contemplated to the municipal electric-light plant involving an expenditure of about $14,000.

URBANA, OHIO.—The City Council has voted to grant the Urbana Lt. Co. a new franchise for a period of 10 years. The recommendation adopted by the Council provides that the company will furnish not less than 100 4-amp metallic-flame arc lamps and such incandescent lamps as the city may require; also ornamental lamp standards carrying two 50-cp and one 80-cp lamp, or four 50-cp and one 80-cp lamp.

FULTON, KY.—The Pub. Ser. Co. of Western Kentucky has been incorporated to take over the Fulton El. Lt., Ht. & Pwr. Co., of Fulton, and the Hickman El., Ice & Wtr. Co., of Hickman. The incorporators are J. H. Boughton, W. C. Morehead and H. L. Lowe.

LEXINGTON, KY.—Arrangements have been made whereby the Wallings Creek Coal Mining Co., the Clover Fork Coal Co. and the Harlan Coal Mining Co. will secure electrical energy from the Kentucky Utilities Co., of Lexington. To furnish the service before the end of the summer the Kentucky company will extend its transmission line into the Hazard section.

LOUISVILLE, KY.—The Louisville Gas & El. Co., it is reported, is contemplating an annex to its power house on Washington Street, which will double the output of the plant, at a cost of $478,361. Overhead bunkers extending east and west along the Water Street front will be constructed to connect with the elevated steam railway tracks on the water front.

ANDERSON, IND.—The contract for the installation of the ornamental street-lighting system in the business district has been awarded to the Richmond El. Co., of Richmond, at $25,000. Specifications call for 315 standards carrying five-lamp clusters.

CENTERVILLE, IND.—Bids will be received by the Board of Commissioners of Wayne County at the office of the county auditor, Richmond, until June 27 for the erection of a transmission line from the town of Centerville to the poor farm, electric wiring, battery, transformers, fixtures, etc., for the poor farm buildings. L. S. Bowman is auditor.

HUNTINGTON, IND.—The Board of Public Works has rejected the proposal submitted by the Huntington Lt. & Fuel Co. for lighting the city, on the ground that the city can supply the service cheaper. Plans and specifications for rebuilding the municipal electric-light plant have been prepared by Engineer Brossman, of Indianapolis. The cost of rebuilding the plant on the present site is estimated at $44,527; the cost of a new plant in the downtown section is estimated at $63,077. F. H. Bowers is president of the Board of Public Works.

ANNA, ILL.—The City Council has renewed the contract for street-lighting with the Central Illinois Pub. Ser. Co. The new contract provides for replacing the present arc lamps, of which there are 53, with 100 tungsten lamps.

AURORA, ILL.—Contracts for the electric wiring, plumbing and heating for the new Aurora City Hospital will soon be let. Worst & Shepardson are the architects.

CHICAGO, ILL.—Bids will be received by John McGillen, clerk of the Sanitary District of Chicago, Room 700, 910 South Michigan Avenue, Chicago, until June 25 for electrical apparatus and supplies as follows: (A) Chicago pole lamp brackets; (B) internal lamp hoist; (C) single conductor lead-covered cable; (D) multiple conductor, 12,000-volt, varnished-cloth, insulated, lead-covered cable; (E) lamp globes. For details, see proposal columns. Thomas A. Smyth is president board of trustees.

CLINTON, ILL.—The citizens on June 10 rejected the proposal of the Clinton Gas & El. Co. to furnish electricity to operate the pumping station of the municipal water-works system. The city may decide to install a municipal electric-light plant.

HAVANA, ILL.—Plans are being considered by the Commercial Club for the installation of an ornamental street-lighting system.

MOLINE, ILL.—Contracts will soon be awarded for electric wiring, heating and plumbing for the new fire station to be built by the city of Moline. E. L. Eastman, commissioner of public health and safety, has charge of the work.

PETERSBURG, ILL.—The Illinois Public Utilities Commission has granted the Abbott Lt. & Pwr. Co., of Petersburg, permission to erect a transmission line from its plant at Petersburg to Ashland and to purchase the municipal electric plant in Ashland for use as a substation.

SPRING VALLEY, ILL.—The Spring Valley Utilities Co. has been granted permission by the Illinois Public Utilities Commission to erect an electric plant in Annawan and extend a transmission line to Mineral, Ill.

MILWAUKEE, WIS.—Plans are being prepared for the installation of a power plant, heating and lighting system and sewerage system at the Milwaukee County Tubercular Sanatarium, to cost about $100,000. R. Messmer & Brothers are architects.

OAKFIELD, WIS.—The Oakfield Lt. & Pwr. Co. has been granted permission by the State Railroad Commission to issue $10,000 in bonds, the proceeds to be used for taking up outstanding indebtedness to provide funds for the erection of a transmission line from the company's distribution system to the terminus of the lines of the Eastern Wisconsin Ry., Lt. & Pwr. Co., of Fond du Lac, with the necessary substation equipment. The Oakfield company proposes to purchase energy from the Wisconsin company.

TOMAHAWK, WIS.—The State Railroad Commission has authorized the Tomahawk Lt. Tel. & Improvement Co. to issue $6,000 in bonds, the proceeds to be used for extensions and improvements to plant.

TREMPEALEAU, WIS.—Bonds to the amount of $8,000 have been voted for the installation of a municipal electric-light plant in Trempealeau.

BUFFALO LAKE, MINN.—The Central Minnesota Lt. & Pwr. Co., of Bird Island, has submitted a proposal to the Village Council asking for a franchise to furnish electricity in Buffalo Lake.

CORRELL, MINN.—Bids will be received by the Board of Education of Correll until June 30 for the erection of a school building. Separate bids to be submitted for the following work: General construction, heating, plumbing and electrical work. Plans and specifications may be obtained from Alban & Lockhart, architects, 407 Chamber of Commerce Building, St. Paul, upon deposit of $10, which will be refunded upon return of same. H. H. De Wall is secretary consolidated school district.

HILLS, MINN.—The town of Hills has engaged Earl D. Jackson, Capitol Bank Building, St. Paul, consulting engineer, to take charge of the construction of the proposed municipal electric-light plant, for which bids, it is understood, will soon be asked.

MINNEAPOLIS, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, until July 6, for erection and completion of the School of Mines at the University of Minnesota, Minneapolis, including the general contract work, heating and ventilating, plumbing and electrical work, in accordance with plans and specifications furnished by C. H. Johnston, architect, 715 Capital Bank Building, St. Paul. Bids will be received collectively and separately. Copies of plans and specifications may be seen at St. Paul and Minneapolis Builders' Exchange, at the office of George H. Hayes, comptroller, University of Minnesota, and at the office of the State Board of Control, Capitol Building, St. Paul.

PINE RIVER, MINN.—The Pine River El. Co., it is reported, contemplates extending its transmission line to Backus.

FARMERSBURG, IA.—The Standard El. Construction Co., of Waterloo, has been awarded the contract for the installation of a 20-kw oil engine plant; also a 200-amp-hour battery and pole line.

GRINNELL, IA.—The Grinnell El. Lt. & Htg. Co. is erecting a transmision line to Brooklyn. The town of Malcolm will submit the proposal to secure electricity from this line to the voters immediately.

HOLSTEIN, IA.—Extensions and improvements are contemplated by the Holstein Ser. Co., including the installation of a 100-hp engine and a 75-kw generator.

LE MARS, IA.—A movement has been started by Dr. W. M. Richey to extend the ornamental street-lighting system in Le Mars, at a cost of $2,000.

MALCOLM, IA.—The Grinnell El. Lt. & Htg. Co., of Grinnell, has applied to the Town Council for a franchise to supply electricity in Malcolm.

MINDEN, IA.—The contract for the installation of a complete electric-lighting system in Minden has been awarded to the Standard El. Construction Co., of Waterloo. The equipment includes one 35-hp and one 15-hp oil engine.

PRIMGHAR, IA.—A committee has been appointed to make investigations for the installation of an electric-lighting system in Primghar.

SANBORN, IA.—The electric plant of the Sanborn El. Co., it is reported, was badly damaged by a windstorm recently.

SILVER CITY, IA.—Harold Boehner, manager of the Malvern Lt. & Pwr. Co., of Malvern, has petitioned the City Council for a franchise to erect transmission lines for the distribution of electricity in Silver City.

WATERLOO, IA.—The contract for the installation of a 10-kw oil engine plant and an 80-amp-hour battery for the new Black Hawk County Home Building has been awarded to the Standard El. Construction Co., of Waterloo.

WAUCOMA, IA.—The city of Waucoma has engaged A. H. Latimer, engineer, to take charge of construction of the proposed municipal electric-light plant, to cost about $12,000. Bids for material have been received. N. A. Hurd is clerk.

WELLMAN, IA.—The Council has granted a private company a franchise to install and operate an electric-light plant in Wellman.

KANSAS CITY, MO.—The City Council has passed an ordinance providing for the installation of ornamental brackets and lamps on Main Street.

ST. LOUIS, MO.—The Light & Devel. Co., of St. Louis, is constructing a power house and water-works reservoir in Cape Girardeau, and also installing three 500-hp boilers; contracts for material have been closed. The company is also installing a 200-hp boiler at its power plant in Monmouth, Ill.

DE SMET, S. D.—The Lake Preston Milling Co., it is reported, contemplates the installation of an electric-light plant to furnish electricity for lighting the town.

NORTH BEND, NEB.—An election will soon be held to submit the proposal to issue bonds for the installation of a municipal electric-light plant to the voters. Plans and specifications for the proposed plant have been prepared by the Fairbanks, Morse Co., of Omaha. Frank Howe is city clerk.

TECUMSEH, NEB.—The Electric Light Commission is contemplating making a special rate for electricity for cooking purposes and expects to purchase ranges and cooking devices of all kinds. W. R. Tasker is superintendent of the municipal electric plant.

HOISINGTON, KAN.—Negotiations are under way between the City Council and the Hoisington El. & Ice Co. for a franchise and also for the installation of an ornamental street-lighting system on Main Street.

POWHATTAN, KAN.—The city of Powhattan is contemplating erecting an electric transmission line and distributing system, bids for which will soon be asked for. L. C. Christensen is city clerk.

Southern States

GREENSBORO, N. C.—The Citizens' Association has practically secured funds for the installation of ornamental lamps in the business section.

APOPKA, FLA.—The City Council will call an election at an early date to submit the proposal to issue $15,000 in bonds, the proceeds of $9,000 to be used for the installation of an electric-lighting system.

TALLAHASSEE, FLA.—The City Council has decided to call an election to submit to the voters the proposal to issue $47,000 in bonds, the proceeds to be used for paving, improvements to electric-light plant and water and gas mains.

CHATTANOOGA, TENN.—The Tennessee Valley Lt. & Pwr. Co., of Chattanooga, is planning to distribute electricity in South Pittsburg, Bridgeport, Tracy City, Monteagle, Sewanee and other cities. The company, it is reported, has contracted with the Chattanooga & Tennessee River Pwr. Co. for electricity from the Hales Bar hydroelectric plant.

DUCKTOWN, TENN.—The machinery of the McPherson mine of the Tennessee Copper Co. will be equipped with electrically operated machinery. The company is installing an electric plant to furnish electricity to operate same.

BAY MINETTE, ALA.—The town of Bay Minette has engaged an engineer to prepare plans and estimates of cost of the installation of a municipal electric-light plant. When plans are completed an election will be held to vote on the proposal to issue bonds for same. J. M. Franklin is clerk.

MERIDIAN, MISS.—The power house of the Meridian Lt. & Ry. Co. was badly damaged recently by an explosion of a 250-hp boiler.

MENA, ARK.—The City Council is reported to have granted the Century Engineering & Construction Co. permission to install an electric system in Mena.

PATTERSON, LA.—The Patterson Lt. & Pwr. Co., it is reported, would like to receive prices on a second-hand 60-kva or 75-kva, three-phase, 60-cycle, 2300-volt generator directly connected to a simple, single-valve engine of sufficient rating to drive same; also second-hand switchboard panel with equipment for control of generator.

LAWTON, OKLA.—The Comanche Lt. & Pwr. Co., of Lawton, it is reported, contemplates the reconstruction of its plant and power house. John C. Keys is general manager, and Albert H. Keys local manager.

POND CREEK, OKLA.—Bonds to the amount of $5,000, it is reported, have been voted for improvements and extensions to the municipal electric-light plant and waterworks system.

CUERO, TEX.—The Texas Southern Electrical Co., of Boston, Mass., has purchased the electric light and power plants at Cuero, Beeville, Victoria, Bishop and Kingsville, and is also negotiating for several other electric plants in Southern Texas. The company has also taken over the rights and franchises of the Cuero Lt. & Pwr. Co., which were recently granted by the State Legislature for the construction of a series of dams across the Guadalupe River and the installation of hydro-electric plants. It is reported that the company proposes to construct an extensive system of interurban electric railways to connect the different towns where it has holdings.

NIXON, TEX.—Preparations are being made by C. D. Puckett for the installation of an electric-light plant. The equipment will include a 50-hp engine, a 30-kw or 37½-kw alternating-current generator, three 2-kva, two 3-kva and two 5-kva transformers, 1¼ miles of No. 10 wire and 100 25-ft. cedar poles and 750 incandescent lamps. The site for the proposed plant has not yet been decided upon. A. L. McKean, of Nixon, is engineer in charge.

Pacific States

ANACORTES, WASH.—Plans are being prepared by the Independent Tel. Co. for the construction of a telephone cable between Anacortes and Lopez, on the San Juan Islands, during the summer.

CHEHALIS, WASH.—The installation of a cluster-lamp lighting system in the business district is under consideration by the City Commisioners.

GOLDENDALE, WASH.—The Board of County Commissioners has granted the Pacific Pwr. & Lt. Co., of Portland, Ore., a franchise to erect and maintain electric transmission lines along certain county roads and highways in Klickitat County.

MONROE, WASH.—Negotiations are under way between the Monroe Wtr. & Lt. Co. and Seattle capitalists for the sale of the local plant. If the deal is carried through, it is understood that extensive improvements will be made.

TILLAMOOK, ORE.—The City Council has granted the Tillamook Lt. & Fuel Co. a franchise for a period of 25 years. The company, it is understood, contemplates extensive improvements.

BANNING, CAL.—The Board of City Trustees has sold to Ghreist & Son, of Newport Beach, a blanket franchise. They propose to install an electric light and power system in Banning. The company also proposes to operate electric plants in Victorville and neighboring towns with headquarters in Banning. Energy for operating the system will be supplied by the Southern Sierras Pwr. Co.

FALL RIVER MILLS, CAL.—Work has begun on the construction of the hydroelectric power plant of the California Pwr. & Mfg. Co. in Fall River Mills to furnish electricity in northeast Shasta County. The equipment will include a 300-hp Leffel turbine, operated under 56-ft. head, Lombard governor (type F), three-phase, 60-cycle, 440-volt Westinghouse generator, General Electric switchboard, General Electric transformers, 440/6600 volts (6600/440 volts and 220/110 volts); Locke insulators (No. 289), wooden poles, 35 ft. (8-in. top, 25 to mile), No. 4 aluminum wire for main line, No. 6 and No. 8 copper wire for branches, and General Electric lightning arresters. Work will be done by the company. E. B. Bunstead, Insurance Exchange Building, San Francisco, is engineer in charge and consulting manager. General offices of the company are located in the Insurance Exchange Building, San Francisco.

LINDSAY, CAL.—The Tulare County Pwr. Co., of Lindsay, has decided to issue $1,000,000 in bonds, the proceeds to be used for erecting main transmission lines and extensions, increasing the output of its steam power plant and to purchase machinery for a hydroelectric power plant to be erected on the Tule River, east of Porterville.

LOS ANGELES, CAL.—The City Council has approved the assessment, plans and specifications for the proposed ornamental lighting system of the Hollywood Boulevard, between Cahuenga Avenue and Wilcox Avenue.

NORDHOFF, CAL.—The Ojai Pwr. Co. has petitioned the State Railroad Commission for permission to issue $19,200, the proceeds to be used for the installation of an additional generating unit to supply electricity for lamps and motors in this vicinity.

SAN FRANCISCO, CAL.—The Supervisors have authorized the Board of Public Works to enter into contracts for electrical wiring, metal lathing and plastering of the academic building of the Polytechnic High School.

SAN FRANCISCO, CAL.—The Board of Supervisors has adopted resolutions directing the removal of all poles and overhead wires in the so-called underground districts. This order affects the following companies: City El. Co., Western Union Tel. Co., California Special Messenger Service, San Francisco Special Messenger Co., American District Tel. Co., Pacific Telephone & Telegraph Co., Pacific Gas & El. Co., Postal Telegraph Co. and Ocean Shore Ry. Co.

HEYBURN, IDAHO.—The Farmers' El. Co., of Heyburn, recently organized, purposes to furnish electricity to farmers in this locality. Electricity for operating the system will be secured from the government power plant located at the Minidoka dam on Snake River. About 3 miles of material for overhead line (35 poles to the mile) will be required; also about 100 incandescent lamps, five meters and 11 transformers. J. M. Butler is secretary and treasurer.

OGDEN, UTAH.—The Ogden Rapid Transit Co. has awarded contracts for material for construction of extensions in Cache Valley, both north and south from Logan, including wire, electrical machinery, etc. It is expected that contracts will soon be placed for wire and other material for the Hermitage-Idlewild extension. P. D. Kline is manager.

PRESCOTT, ARIZ.—The Arizona Pwr. Co., of Prescott, is contemplating installing an additional generating unit in its plant on Fossil Creek. R. S. Masson, Security Building, Los Angeles, Cal., is vice-president.

TUCSON, ARIZ.—Bids will be received at the office of the city clerk, Tucson, until July 6 for 60 or more five-lamp and 26 or more one-lamp ornamental street-lamp standards, without globes or bulbs. For details see proposal columns.

BAKER, MONT.—A special election will be held June 23 to submit the proposal to grant E. G. Heinrich a 20-year franchise to construct and operate an electric-light plant in Baker.

GREAT FALLS, MONT.—The City Council has authorized the installation of ornamental lamp standards on First Avenue North, to cost $126.50 each installed.

LIVINGSTON, MONT.—The Northern Pacific Ry. Co. will soon begin work on the installation of an automatic block signal system, between Livingston and Toston, a distance of 195 miles. The company is also planning to reconstruct the telegraph and telephone system between this city and Missoula.

LOVELAND, COL.—At a mass meeting held recently the citizens voted to establish a municipal electric-light plant, to cost about $12,000. Power for operating the proposed plant will be secured from the waterfalls in Big Thompson River, about 12 miles from Loveland. Filings have already been made on power site.

FALLON, NEV.—Bids will be received at the office of the United Reclamation Service, Fallon, Nev., until June 25 for the lease from the United States of the electric power plant at Lahontan, Truckee-Carson project, Nevada. For particulars address the United States Reclamation Service at Washington, D. C., Fallon, Nev., or 605 Federal Building, Los Angeles, Cal. A. P. Davis is chief engineer.

Canada

EDMONTON, ALTA.—The City Council has rejected the proposal submitted by the United Colliery, Ltd., of Winnipeg, for furnishing electricity in Edmonton, generated at one of its mines, a few miles from Edmonton.

ESTEVAN, SASK.—Tenders will be received by P. J. Stephens, secretary and treasurer, until July 1 for furnishing and installing two 250-kw, three-phase, 60-cycle, 2300-volt generators for direct connection to engine, two exciters for direct connection to above generators, one 500-kw, three-phase, 60-cycle, 2300-volt alternating-current generator for direct connection to engine, one exciter for direct connection to above generator, three gas engines using producer gas, complete with all gas generators, tar and dust extractors, and all the necessary gas and water piping, one switchboard complete for the above units. For further particulars address S. G. Detheridge, town electrical engineer, of Estevan.

MOOSE JAW, SASK.—The Electrical Department is contemplating improvements to the municipal electric-light plant, including the installation of 1000-hp boilers, water-softening plant, 15-kw motor-driven exciter set, eight 100-lb. dump automatic coal scales, complete new piping for 3500-hp steam plant, line extensions, meters and transformers. J. D. Peters, superintendent of electrical department, will have charge of the work.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, Panama Canal, Washington, D. C., until June 25 for steel cable, pipe fittings, valves, curb boxes, copper gaskets, shavings exhaust system for planing mill, steel plates and angles, etc. Blanks and general information relating to this circular (No. 857) may be obtained at the above office or from the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal.

New Incorporations

MUNFORDVILLE, KY.—The New Munfordville El. Lt. & Pwr. Co. has been incorporated with a capital stock of $2,800 by F. W. Wheeler, J. W. Payton, J. M. Craddock and Richard Lobb.

SAULT STE. MARIE, MICH.—The Chippewa Edison Co. has filed articles of incorporation for the purpose of furnishing electricity in this county. The company proposes to erect transmission lines connecting Brimley, Rudyard and Pickford with Sault Ste. Marie as soon as possible. It is also planning to extend its lines to Dafter, Cedarville and vicinity. The officers are: F. R. Warner, president; William Chandler, vice-president; W. W. Edwards, secretary; Edward Horry, treasurer; Thomas Chandler, general manager, and Allen Scherzer, superintendent.

KANSAS CITY, MO.—The Western Utilities Co. has been organized to promote and operate electric light and power plants. The office of the company is located in the Orear-Leslie Building, Kansas City. F. J. Buckley is manager.

NEW YORK, N. Y.—The Equitable Lt. & Pwr. Co. has filed articles of incorporation with a capital stock of $250,000 under the laws of the State of Delaware. The incorporators are Randall W. Borough, J. Stanley, of Lyon, and W. I. N. Lofland, of Dover, Del. The company proposes to construct and operate electric and gas plants.

SOUTHOLD, N. Y.—The Cutchogue El. Co. has been incorporated with a capital stock of $10,000 to furnish light, heat and power. The incorporators are W. A. Fleet, J. B. Roach and S. H. Moore.

HOT SPRINGS, N. C.—The Industrial Pwr. Co. has been incorporated by Archibald Nichols, S. M. Hanes, and James E. Rector, of Asheville, N. C. The company is capitalized at $100,000 and proposes to build a hydroelectric power plant and erect long-distance transmission lines to supply electricity for commercial purposes.

SPARTANBURG, S. C.—The Shores-Osborne El. Co., of Spartanburg, has been chartered with a capital stock of $15,000 to build and operate an electric-light plant and to do a general construction business. The incorporators are R. A. Shores, Wallace Osborne and C. E. Rogers.

JASPER, TENN.—The Bays Mountain El. Co. has been chartered with a capital stock of $25,000. The incorporators are Joseph Burger, J. L. Clark, Ernest Koella and others.

McALLEN, TEX.—The Rio Grande Pub. Ser. Corpn. has been incorporated with a capital stock of $80,000 by R. L. Lewis, T. J. Powell and D. W. Glasscock.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 9, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,039,164. PARTY-LINE RINGING KEY; A. J. Carter, Chicago, Ill. App. filed Aug. 27, 1913. Indicating type.

1,099,211. PROCESS OF AND APPARATUS FOR PRODUCING ZINC AND OTHER SIMILAR METALS; H. Specketer, Griesham-on-the-Main, Germany. App. filed May 6, 1912. Revolving furnace.

1,099,241. RECTIFIER; T. A. Edison, Llewellyn Park, West Orange, N. J. App. filed Oct. 7, 1910. Sparkless commutator.

1,099,259. ELECTRIC TRAFFIC CONTROLLING SYSTEM FOR RAILROADS; W. H. Lane, Westfield, N. J., and A. V. T. Day, New Rochelle, N. Y. App. filed July 9, 1908. Continuously conductive track rails and heavy cross bonds.

1,099,268. PANELBOARD CABINET; C. D. Platt, Bridgeport, Conn. App. filed Feb. 6, 1913. Employing snap switches.

1,099,283. RAILWAY SIGNALING SYSTEM; A. V. T. Day, New Rochelle, N. Y. App. filed Aug. 28, 1908. Employs relays responsive to different frequencies.

1,099,313. ELECTRIC SWITCH; J. G. Peterson, Hartford, Conn. App. filed Oct. 2, 1911. Rocker construction for push-button switch.

1,099,320. WIRE-SECURING DEVICE; J. F. Southgate, Worcester, Mass. App. filed July 2, 1913. Staple carrying wire-encircling insulating strip.

1,099,332. CIRCUIT-BREAKER; C. Aalborg, Wilkinsburg, Pa. App. filed July 3, 1905. Prevented from remaining in its closed position under overload conditions.

1,099,338. COMBINED SIGNALING AND TELEPHONE SYSTEM; M. J. Carney, Chicago, Ill. App. filed Dec. 27, 1904. Transmits signal alarms, fire, etc., at same time with telephonic messages.

1,099,343. AUTOMATIC EXCHANGE SELECTOR; E. B. Craft, Hackensack, N. J. App. filed March 1, 1911. Embodies a rotating shaft carrying a contact sleeve axially movable thereon.

1,099,365. COMBINED SPARK PLUG AND VAPORIZER FOR INTERNAL-COMBUSTION ENGINES; J. C. Henderson, Washington, D. C. App. filed Jan. 21, 1914. Spark plug carries an electric heating element which can be switched in at starting.

1,099,374. INSULATOR; I. Hunter, Carlisle, Ky. App. filed Aug. 18, 1913. Wire-receiving cylindrical insulator sections seated in bore in the cross-arm.

1,099,375. ELECTRODE MATERIAL FOR VAPOR ELECTRIC APPARATUS; R. P. Jackson, Edgewood Park, Pa. App. filed July 17, 1912. Mercury and a fractional percentage of lead.

1,099,381. ELECTRIC POCKET LAMP; W. Krafft, Berlin, Germany. App. filed Jan. 24, 1914. Series resistance mounted on one of the contact springs of the battery cell.

1,099,384. TROLLEY POLE; J. Ledwinka, Philadelphia, Pa. App. filed Sept. 27, 1909. For "trackless trolleys."

1,099,386. STATION INDICATOR; C. S. Mackearnin, Boston, Mass. App. filed April 21, 1909. Indicating band under push-button control.

1,099,390. WIRE SPLICER; J. O. Mulligan, Eccles, W. Va. App. filed Nov. 19, 1913. Ends of trolley wire held in clamps which are relatively adjustable.

1,099,397. ALARM SYSTEM; G. A. Sabine, Robinson, Md. App. filed April 26, 1913. Plurality of related circuits with periodic circuit closer in main circuit.

1,099,406. RELAY FOR TELEPHONES; C. Stille, Berlin, Germany. App. filed Jan. 11, 1910. Two coils having a contact resistance between them are caused to move against one another in a strong magnetic field.

1,099,421. HIGH-VOLTAGE SWITCH; A. W. Burke, Pittsburgh, Pa. App. filed June 14, 1911. For opening circuit under load; has diverging arc horns which engage before and disengage after the switch members engage.

1,099,440. ELECTRICAL INDUCTION FURNACE; K. A. F. Hiorth, Christiania, Norway. App. filed Oct. 8, 1913. Disk transformer type.

1,099,469. RAILWAY TRAFFIC CONTROLING APPARATUS; W. H. Reichard, Troy, N. Y. App. filed Dec. 14, 1910. Alternating-current motor and direct-current indication magnet.

1,099,480. SIGNAL ALARM; F. Winter, New York, N. Y. App. filed March 16, 1912. Wire embedded in plate glass so as to be broken by fracturing of the glass.

1,099,512. SAFETY STOP; L. R. Palmer, Pittsburgh, Pa. App. filed Jan. 30, 1911. For electric cranes; to prevent lifting the load too high.

1,099,550. TELEPHONE SET; P. L. Jensen and E. S. Pridham, Napa, Cal. App. filed Sept. 3, 1913. Has a sound box and a hollow stationary arm carrying an earpiece.

1,099,558. ELECTRODE; F. J. Machalske, Plattsburg, N. Y. App. filed June 27, 1913. Refractory magnesium and graphite.

1,099,559. ELECTRIC FURNACE; F. J. Machalske, Plattsburg, N. Y. App. filed June 27, 1913. Bottom and lower side walls lined with artificial graphitic carbon and adjacent wall portions covered with magnesite.

1,099,562. ELECTRICAL CURRENT LIMITING DEVICE; M. Mertens, Berlin, Germany. App. filed Nov. 14, 1911. A slight overload causes circuit to be intermittently interrupted and heavy overload causes permanent break.

1,099,589. FUSE; F. B. Cook, Chicago, Ill. App. filed May 10, 1911. Embodies a fuse wire wrapped about a notched mica strip.

1,099,590. PROTECTIVE DEVICE; E. E. F. Creighton, Schenectady, N. Y. App. filed July 13, 1907. Ground connection with spark-gap electrodes and plurality of circuits of different inductance.

1,099,595. PROCESS OF AND APPARATUS FOR HEATING; F. Fischer, Charlottenburg, Germany. App. filed Oct. 6, 1913. Heats by a metallic resistor in a chamber full of hydrogen.

1,099,618. TROLLEY; W. Rohkohl, Potsdam, Germany. App. filed Feb. 3, 1914. Pantograph carrying plurality of contacts.

1,099,625. MOTOR-OPERATED SWITCH; H. M. Stevens, Schenectady, N. Y. App. filed May 28, 1906. Remote control type.

1,099,635. NON-SHORT-CIRCUITING LAMP SOCKET; E. E. Brown, Philadelphia, Pa. App. filed Oct. 20, 1913. Spring member overlies center contact and is engaged with same by lamp inserted in the socket.

1,099,654. METHOD AND MEANS FOR TREATING ELECTRODES; C. P. Landreth, Philadelphia, Pa. App. filed Feb. 21, 1913. For preventing coating or oxidation of electrodes used in electrolytic apparatus.

1,099,658. HEATING APPARATUS; G. Machlet, Jr., Elizabeth, N. J. App. filed Aug. 1, 1906. Supply of gaseous or liquid fuel to furnace regulated by the heat of the furnace itself.

1,099,673. AUTOMATIC SHIP'S TELEGRAPH ALARM; J. A. Sullivan, Victoria, British Columbia, Canada. App. filed Feb. 26, 1913. Audible means indicates to engineer when the position of the way-shaft does not correspond to position indicated by the ship's telegraph.

1,099,683. METER-CONTROL PANELBOARD; F. B. Adam, St. Louis, Mo. App. filed April 6, 1912. Any circuit busbar can be connected to any meter busbar on the board.

1,099,704. MANUFACTURE OF METALLIC ILLUMINATING BODIES FOR ELECTRIC INCANDESCENT LAMPS; E. Hurwitz, Berlin, Germany. App. filed Oct. 16, 1906. Eliminates cementing means from the metallic particles by sintering.

1,099,709. METHOD OF SMELTING ORES; F. J. Machalske, Plattsburg, N. Y. App. filed June 27, 1913. Forms basic charge of iron ore, artificial graphite and lime and subjects to electric current.

1,099,721. INCANDESCENT LAMP; M. von Pirani, Wilmersdorf, Germany. App. filed Nov. 23, 1912. Halogen compound of silver in the lamp bulb in effective relation to the filament.

1,099,744. GUARD FOR ELECTRIC CONDUCTORS; H. W. Gonia, Berwind, W. Va. App. filed Oct. 25, 1913. For use in mines; swinging guards prevent person's head coming into contact with the overhead trolley wire.

1,099,777. PORTABLE BURGLAR ALARM; S. Sundel, New York, N. Y. App. filed Nov. 16, 1912. For travelers; designed for ready attachment to a door or window.

1,099,786. ELECTRIC HEATER; C. F. Brown and W. T. Lowry, Chattanooga, Tenn. App. filed April 3, 1914. Made of steatite, which is channeled to receive and support heater wires of different circuits.

1,099,795. RAILWAY BLOCK-SIGNAL SYSTEM; A. S. Gross, Fremont, Neb. App. filed July 17, 1912. Each block has signaling apparatus independent of other blocks.

1,099,799. METHOD OF AND APPARATUS FOR REMOVING OR DISSIPATING STATIC ELECTRICITY FROM PAPER, CLOTH, YARN, ETC.; A. C. Heiny, New York, N. Y. App. filed April 14, 1909. Charged dielectric is brought into an alternating electrostatic field, which is gradually suppressed.

1,099,812. CIRCUIT CONTACT-CLOSING DEVICE; G. C. Murphy, Louisville, Ky. App. filed July 30, 1913. For signalling between passing cars.

1,099,861. PORTABLE WIRELESS-STATION TOWER; J. Raes, Schenectady, N. Y. App. filed Nov. 9, 1912. Auto carrying extensible towers.

1,099,865. WIRELESS RECEIVING SYSTEM; E. G. Stalnaker, Minor, Chicago, Ill. App. filed June 15, 1912. Tuning set which is self-adjusting, being actuated by the incoming wireless impulse.

1,099,892. ELECTRICALLY HEATED STAMPING PRESS; L. Airhart, West Reading, Pa. App. filed Dec. 3, 1913. Self-contained means for regulating the electric heating combined with the die of the press.